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## ORIGINAL COMMUNICATIONS.

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### THE CATARRHAL INFLAMMATION OF THE NASAL ACCESSORY SINUSES, AND ITS DIAGNOSIS.*

DR. OSKAR HIRSCH, Vienna.

Inflammation of the accessory sinuses was divided by Zuckerkandl into *catarrhal* and *suppurative*. This division was confirmed by Dmochowsky, Harke and E. Fränkel, and is mentioned also by Hajek in his work, "Pathology and Treatment of Inflammations of the Nasal Accessory Sinuses."

By *catarrhal inflammation* Zuckerkandl understood an inflammation of the antrum of Highmore, in which there is a serous infiltration of the mucosa. The mucous membrane is swollen to ten or fifteen times its normal thickness, and appears jelly-like. According to Zuckerkandl the exudate varies in amount, and is mostly mucus. He distinguishes acute and chronic catarrhal inflammation.

From these observations of Zuckerkandl, which were made on the result of post-mortems, I differ in that I find the discharge from the antrum is absent in most of the chronic cases, and the *exudate takes place most often in the tissue of the mucosa,* and rarely on the surface.

In *suppurative inflammation,* usually called empyema, the mucosa may also be swollen, but to a less extent than in the catarrhal variety. Here the chief characteristic is the exudate, which is either pure pus or mucopus.

As the suppurative inflammations give rise to purulent discharge into the cavity of the accessory sinus, which is then discharged from the ostium into the nose, they become manifest in the nasal cavity.

*According to demonstrations in the Vienna Laryngolog. Society, 1922-24; Monatsschr. f. Ohrenhlk., 1922-25.

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As our methods of examination of the antrum are based on washing it out, and finding pus in the washing, it is understandable that the suppurative inflammations can be detected at a relatively early stage, while the catarrhal inflammations which frequently occur without secretion have been overlooked in the past, and are still overlooked in spite of their detailed description by Zuckerkandl.

If the washing of the accessory sinus, *e. g.*, the antrum of Highmore, which is most often affected, is positive we diagnose empyema. But if negative, we have taken no further notice of the antrum, and so it has happened that catarrhal inflammations have for so long been overlooked. But Hajek has described an inflammation of the ethmoid, which—though he does not call it catarrhal—corresponds to that described by Zuckerkandl. Hajek calls this special inflammation of the ethmoid polypoid degeneration. The cause of this, he explains, is due to the special histological structure of the loose structure of the mucosa of the ethmoid, which becomes edematous as a result of inflammatory irritation.

Hajek's polypoid degeneration is equivalent to catarrhal inflammation, and so we can say that Hajek recognizes catarrhal inflammation in the ethmoid.

That the special inflammation was found in the ethmoid is also understandable as the larger part of the ethmoid is visible on rhinoscopy, and hence its changes first struck Hajek. Afterwards he found similar changes in the ethmoidal labyrinth itself.

After Hajek, Uffenorde, in his monograph on ethmoidal diseases, describes Zuckerkandl's two types of suppurative and catarrhal sinusitis, and in a later paper, he extends the distinction to the other accessory sinuses. (Zeitschr. f. Ohrenhlk., v. 72, p. 133.)

However important these papers of Uffenorde were, they attracted as little attention as those of Zuckerkandl on the same subject, as neither of these writers gave a precise description of clinical diagnosis of the condition.

My interest in choanal polyps and later on in ordinary polyps led me to a fuller understanding of catarrhal antral inflammation. I found that choanal polyps are an incarcerated prolapse of the mucosa of the maxillary antrum.* As a result of this connection I deduced that the ordinary polyps also originate from the maxillary sinus. Hence, as a result of this conclusion, in a case of recurring nasal polyps, I operated on an antrum, in spite of a negative puncture, and discovered a most striking picture, as I had never seen before. The whole antrum was filled by transparent edematous mucosa hanging

*Monatsschr. f. Ohrenhlk., 1921, published by my assistant, Dr. Forschner.

from the walls in polypoid ridges. I removed the edematous mucous membrane, and this on examination had a histological appearance similar to nasal polypi. There was no secretion in the antrum (Fig. 1.).

This first case taught me three new facts:

*1.* I had found a form of antral inflammation which I had never seen before: an edema of high degree without suppuration. I remembered the descriptions of Zuckerkandl and Uffenorde of the catarrhal form of antral suppuration, and a mention of this by Hajek. Now I understood that for the first time I had seen a pronounced form of catarrhal antral inflammation; for the other case was one of choanal polyps arising from the antrum which were in process of involution.

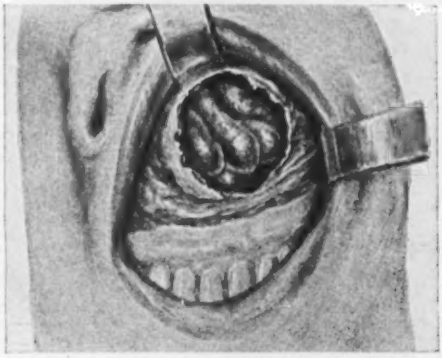

Fig. 1. Chronic catarrhal antral inflammation. The sinus is filled by edematous convolutes. (Drawn during Hirsch's operation.)

*2.* The second fact this case taught me was the *similarity in the histology of the edematous antral mucosa, and of the polyps in the nose.* This proved that ordinary polyps arise in the antrum, as I had previously suspected. In this case there was a marked degree of antral inflammation, which I had presupposed as a cause of choanal polyps, but in my case of choanal polyps the mucosa was in a state of involution.

*3.* This comparison between the mucosa of the antrum in the cases of choanal polyps, and in relapsing nasal polyps caused me to recognize *two forms of catarrhal inflammation of the antral mucosa; a.* a form capable of involution; *b.* a form incapable of involution. Hence I confirmed Zuckerkandl's description of acute and chronic inflammations of the antrum.

After verifying by my first case the supposition that nasal polyps arise in the antrum, I opened up the antrum in fifteen other cases of recurring nasal polypi, and found in all a high degree of catarrhal inflammation. In all these cases the antrum wash out was negative. In two cases there was some secretion in the washing, but it was so small in quantity that the washing could not be called positive.

Regarding the findings in opening up the antrum in cases of recurring nasal polypi with negative washing of the antrum, I can briefly summarize:

*1.* The *chronic* form of catarrhal antral inflammation was found in all cases of recurring polypi. In two cases there was a catarrhal inflammation of other cavities, in addition to the antrum.

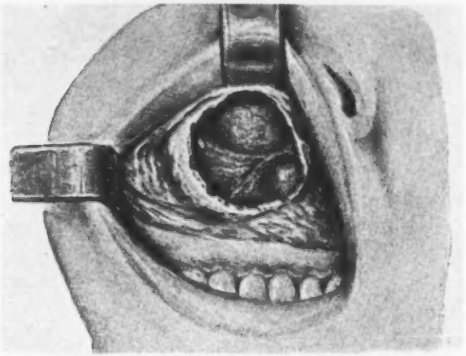

Fig. 2. Chronic catarrhal antral inflammation: The mucous membrane forms a tent-like elevation filled by an edematous fluid, continuing into a cord. (Drawn during Hirsch's operation.)

*2.* The chronic catarrhal antral inflammation appears in two forms. The most frequent is that described by Zuckerkandl, that which appears on the antral walls as edematous ridges, and fills up the cavity completely (Fig. 1).

In some cases I have found another form, in which the antral walls are filled with edematous mucosa, which has been drawn out to form a cord. In Fig. 2 I have shown the picture of such an antrum, its walls covered by a chronic catarrhal mucosa, containing a cord of mucous membrane. The cord is not of uniform thickness, but is a tent-like elevation of the mucosa, full of serous fluid, and continues as a cord leading to the natural ostium, and the accessory ostium of the maxillary sinus. On this cord either ordinary or choanal polyps hang in the nasal cavity.

This cord has its origin from that part of the mucous membrane which prolapses through the openings of the maxillary sinus in the most acute stage of inflammation, or in an acute exacerbation of a chronic inflammation. As a result of the swelling of the peripheral end it can no longer involute. This cord corresponds in its origin with the pedicle of a choanal polyp, but the pedicle of choanal polyps is thinner—at least in the one examined—because when the stage of acute catarrhal inflammation, in which it arises, subsides, the pedicle is pulled out more. The cord formation in the chronic form is broader, as the tendency to involution is minimal, and the drag on the incarcerated mucosa is less.

Such cases of cord formation in the antrum are illustrated in Zuckerkandl's book, but he gives no explanation of their origin.

*3.* Of the remaining results, in the cases of operated maxillary sinuses, I mention the *possible subsidence of nasal polypi, after the removal of chronic catarrhal antral mucosa.* The subsidence occurred in a few cases only, in those with cord formation, and also in two cases without cord formation. In three other cases the polyps had shrunk. The nasal polyps in all cases operated on by myself showed prior to operation a great tendency to recur, but after operation there have been no recurrences, with the exception of two cases. The recurrence in those two cases occurred in cavities which had not been operated on.

I conclude, from the invariable connection between chronic catarrhal inflammation and recurring nasal polypi; from the identical histological characters of nasal polyps and chronic catarrhal antral mucosa; from the involution of nasal polypi in some cases after removal of the diseased antral mucosa, that recurring nasal polypi are the result of chronic catarrh of the mucous membrane of the accessory sinuses. On the other hand, we can conclude, from the presence of recurring nasal polyps, that a chronic catarrhal inflammation of an accessory sinus is present. The antrum will be found most often the seat of suppurative disease, as I have found in all my cases, but I must emphasize that *I do not regard the antrum as the only source* of recurring nasal polyps, as all the other sinuses may give rise to similar polyps when their mucosa becomes the seat of a chronic catarrhal disease.

We can make a comparison between the suppurative inflammations of the accessory sinuses, the diagnosis of which Hajek in teaching and writing has made known to all rhinologists, and the catarrhal inflammations, where clinical diagnosis had not been described until now. *The reappearance of pus in the nose, after it has been wiped*

*away, has the same importance in suppurative diseases of the sinuses as recurring nasal polypi have in the diagnosis of chronic catarrhal disease. In the same way as the streak of pus in the middle meatus means suppuration in maxillary, frontal or anterior ethmoidal cavities, and in the olfactory fissure means suppuration in the sphenoidal and posterior ethmoidal sinuses, recurring nasal polypi in the middle meatus result from chronic catarrhal inflammation in the antrum, frontal or anterior ethmoidal cavities, and in the olfactory fissure, or in the superior meatus from catarrhal inflammation in the sphenoid or posterior ethmoidal cavities.*

This parallel also holds in the relative frequency of the cavity affected. In both, suppurative and catarrhal disease, the antrum comes first in the frequency of infection. In most cases nasal polypi arise from the antrum, though until now they had been considered to have their origin mainly in the ethmoid. They appear to arise from the ethmoid because the antral ostium opens through the ethmoid.

As the streak of pus in the middle meatus does not tell us which or how many of the three cavities opening in that meatus are infected, we cannot recognize from the presence of recurring polyps in the middle meatus, which and how many of the three cavities are the site of chronic catarrhal inflammation.

In suppurative infections washing out the various cavities indicates those diseased, but in chronic catarrhal inflammations the X-ray picture gives us most help, as the washings are negative.

Only puncture of the antrum may be used for diagnosing a chronic catarrh in a case where there is discharge of a serous liquid through the needle, or on aspiration by a syringe. But a negative result in this puncture is of no importance in the diagnosis of a chronic catarrhal inflammation.

In my experience an X-ray picture is a reliable aid to diagnosis in the majority of cases, but occasionally it is negative even when changes in the cavities are present. But such errors in the X-ray results are exceptions.

By the term "recurring nasal polypi" we do not only refer to those sudden rare recurrences, *e. g.*, those recurring a few days after removal, but also to those recurring after some months. Two cases of sudden recurrence have already been described by Hajek many years ago (Arch. f. Lar., v. 14, 1903). In these two cases the recurrence took place so rapidly and suddenly that Hajek then considered the polyps could not grow again from the same place, but must come from a reservoir such as the antrum. This he confirmed at subsequent operation. From these cases Hajek concluded that rapid recur-

rence of polyps in the middle meatus, if the ethmoid labyrinth were excluded, after resection of the middle turbinate, means that the polyps arise in the antrum.

Hajek has only published two cases from his rich experience and extensive material as a contribution to the diagnosis of antral polyposis, and he considers them benign tumors of the antrum. For this reason Hajek's publication remained an important and interesting contribution to the diagnosis of polyps. Today we regard this publication of Hajek's as an important contribution to the diagnosis of catarrhal antral inflammation, and *we do not consider it a rare occurrence.* According to my investigation, *all recurring polyps,* whether recurring soon or late after removal, *are a symptom of catarrhal inflammation of accessory sinuses.*

There are other symptoms of catarrhal inflammation of the sinuses besides those already mentioned: recurring polypi, serous discharge from the needle on puncture, spontaneous discharge of serous liquid from the nose. The chief symptom is *serous coryza. I believe the greater number of those cases we call vasomotor rhinitis are caused by catarrhal inflammation of the accessory sinuses.* In these cases I should advise routine X-ray examination of the sinuses, in order to exclude a latent catarrhal inflammation.

A certain number of these catarrhal inflammatory sinuses will escape diagnosis, in spite of the objective symptoms. It is not every catarrhal inflammation which gives rise to polypi, nor can it be detected by puncture or aspiration. Some cases will have no symptoms. Thus, some time ago I operated on a patient with a chardoma of the base of the skull and pharynx by Denker's method for removal of pharyngeal tumors. The X-ray showed a shadow in the antrum, so I thought the tumor had also penetrated the superior maxilla. But when I opened the antrum it was filled with edematous mucosa—a catarrhal inflammation—and the tumor had not invaded the cavity. It had only eroded the posterior bony wall of the antrum without infiltrating the mucosa, and caused an inflammatory irritation. Hence there was a catarrhal inflammation of high degree without polyp formation. The subjective symptoms of the patient were of no value in making the diagnosis of tumor in this case.

It remains for us to bring the catarrhal inflammations within the possibility of diagnosis. At least we must find out the indications which will make us suspect such a latent condition, so that we can definitely decide by the X-ray whether they are present.

*Histologically* the catarrhal antral inflammation is characterized by the great amount of edema, and strands of connective tissue are

separated as in polyps. The small-celled infiltration is limited to the subepithelial layer, as Zuckerkandl described, Uffenorde in his extensive work confirmed, and my own histological examinations prove.

The difference between catarrhal and suppurative lesions of the mucosa is most distinct in some places and less in others. This may be the reason why many authors do not recognize a fundamental difference between these two types of inflammation. Clinically and macroscopically the difference is more marked. Whoever has once seen a well pronounced form of catarrhal sinus inflammation at operation will be struck by this difference. The different terms which have been applied to it in the past are as follows: inflammatory hydrops, polyposis of the antrum, phlegmon of the accessory sinuses (Weichslbaum), etc.; these terms prove it is macroscopically entirely different from suppurative inflammation.

That the difference in the histological picture is not pronounced is the result of the fixing processes; the edema of the tissue disappears largely in its preparation, and, further, there are transitional stages between catarrhal and suppurative inflammations.

Some authors do not consider catarrhal inflammation of the accessory sinuses an inflammation, but an obstructive edema, or a non-inflammatory edema. The observation that in general circulatory obstruction there is no pronounced edema in the accessory sinuses is against this supposition. These objections can be understood when we remember how indefinite the pathological conception of inflammation is, and also how long it took to establish the inflammatory character of polyps, which histologically are identical with a catarrhal inflammation of the accessory sinus mucosa.

In the cases of catarrhal inflammation of the antrum where I operated by opening through the canine fossa I was struck by the extraordinary thinness of the bone. At first I thought this accidental, and explained it as the result of a large maxillary sinus—as was actually the case. But in my last cases I found at operation *defects in the canine fossa,* though the patients were younger, and there was no question of senile atrophy. These defects indicate why the bony walls were so thin in chronic catarrhal inflammation. When we consider that bony defects in the antral walls are normally exceedingly rare, even in old age, and yet that among fifteen cases of chronic antral catarrh I operated on, two had bony defects, we must conclude that *chronic catarrhal inflammation is accompanied by bone resorption.* Although in several cases I have examined histological sections of the antral wall I have not found any osteoclasts, even in that part lining the defects. But we cannot allow this negative histological

result to weigh against my explanation, for first a defect in the bone is macroscopic, and the result of bone resorption, and need not be confirmed histologically, and, secondly, it is known that in slow bone resorption over a period of years osteoclasts are present in small numbers, and are not easy to find (Maresch). Uffenorde has already seen such defects in chronic catarrhal inflammations. Also, Hajek has found atrophic processes in the ethmoid, most marked at the point of insertion of polyps. But the polyps arise by a chronic catarrhal inflammation, and thus Hajek's histological findings agree with my own macroscopical findings.

In the foregoing I have shown that catarrhal inflammations of accessory sinuses are clinically, macroscopically, and usually histologically inflammations of a special type. In the symptomatology of catarrhal inflammations I should like to draw your attention especially to the frequency of asthma. Among the fifteen cases I operated on five had asthma. Four of them had asthma prior to operation, the fifth had a first attack several months after operation, following influenza and a sinusitis of the nonoperated accessory cavities.

The frequent occurrence of asthma with catarrhal infections makes one suspicious that some original connection may exist. I am not intending to add another theory to those already in existence on the origin of asthma, but I shall defer my publication on this subject until I have increased the number of my observations. I should like to add that other cases of severe bronchial asthma which I remember years ago had recurring polyps.

*The knowledge of catarrhal inflammations of the accessory sinuses and, above all, the points in their diagnosis fill a gap in the pathology and diagnosis of accessory sinus inflammations. Another correspondence exists between the middle ear and the accessory sinuses, where the catarrhal inflammation of the accessory sinuses correspond to the secretory or catarrhal infection of the middle ear, and suppurative diseases of the accessory sinuses to the suppurative middle ear inflammations. The above mentioned cord formations in the maxillary sinuses would correspond to those changes in the middle ear from which adhesive processes develop.*

Josefstadterstrasse 21.

## PRESENTATION OF CASES OF SINUSITIS.*

DR. JULIUS I. KLEPPER, New York.

The cases that I am presenting to you tonight illustrate the wide variety of symptoms and complications that may arise from nasal sinus infections, sometimes without definite clinical evidence of sinusitis.

*The first case* is one of pansinusitis and osteomyelitis of the skull. The patient, E. R., was wheeled into the clinic in a very serious condition on March 16, 1925. He was then too sick to give any account of his previous symptoms, but the following history, obtained in part from his wife, was later completed by the patient's own statement of the case.

On Jan. 13, 1925, he had pain in the right side of the face, discharge of pus from the right nostril and headache; he was treated by Dr. J. F. for neuritis. Two weeks later he suffered terrific pain radiating from the temple to the lower jaw and back again. The face started to swell from in front of the ear down to the neck; the swelling became "hard and stony," and "grew to the size of a small melon" (the patient's own words). Dr. F. sent him to the L. Hospital, where he was operated for peritonsillar abscess. On Feb. 15, he was operated behind the right lower jaw and attended the clinic for three weeks. On March 15, 1925, he called Dr. A. A. D., who advised him to go to the New York Post-Graduate Hospital, "if he lived until morning," as the patient quoted the doctor). Thus, more than two months after the onset of symptoms, he was admitted to the clinic on March 16.

*Objective symptoms:* Patient's facial appearance was ashy, anemic, toxic; he was unable to open his jaw, or to swallow; by forcing the jaw, the left side could be slightly opened. Both tonsillar pillars and also the soft palate were very much swollen. There was an incision behind the right lower jaw, draining pus. Nasal examination showed the following: Both sides were very edematous with purulent discharge of a foul character. After much cleaning and suction, pus came pouring from the middle meati.

*Case 1:* The mucous membrane was necrosed and loaded with pus; on palpation of the nasopharynx and pressing on the swollen

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*Read before the New York Academy of Medicine, Section on Laryngology and Rhinology, May 26, 1926.

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area, large quantities of pus came pouring from the nose (all in all about 2 ounces of pus). On the right temporal region there was a large mass the size of a fist projecting in front of the ear and extending almost to the frontal bone.

The temporary diagnosis was pansinusitis with abscess of the right temporal region. The patient was immediately admitted to the hospital and was operated that same afternoon under local anesthesia. The temporal abscess was thoroughly opened; a purulent secretion with a very foul odor came out, about 4 to 6 ounces. The wound was curetted. The bone felt rough and fissured, and we were almost afraid to press on it because of the danger of its breaking down into the brain. A slight antrotomy was done; the wall was chiseled through, and the antrum washed; a foul discharge came out. As the patient was very weak, he was immediately sent back to bed in the

Fig. 1.

ward, with the necessary order for stimulation. An X-ray was ordered, which showed signs of fissure of the temporal bone. Wassermann negative.

The diagnosis based on antrum irrigations and the report on pathological specimens was osteomyelitis of the antrum, polypoid degeneratoin of the mucous membrane; osteomyelitis of the right lateral nasal wall, the latter being much necrosed in places. On March 24, we ordered a blood transfusion. On March 25, a double Kuhnt operation was performed under local anesthesia, the right side first. We found the septum broken down by necrosis and pus coming out of both sinuses under pressure. The sinuses were curetted and packed according to the Kuhnt method. Healing took place by granulation. Pathological report showed a very severe subacute, purulent sinusitis. No fistula was found leading to the temporal bone, therefore, the

temporal bone infection was not due to a fistula of the frontal sinus. From this time on the condition of the patient showed marked improvement, but there was still a lot to be done.

On March 27, two days later, the nasal polypi, the middle turbinate, and the ethmoids were removed. At this time the patient contracted erysipelas from a case of plastic operation in the same ward. The patient came through this attack, but developed an abscess inside the mouth at the angle of the jaw; this was opened through the mouth. Probing led us to believe that it came from the angle of the lower jaw, leading to the scar on the neck, where the original incision was made before the patient came to the hospital.

The X-ray report at this time showed roughening of the inferior margin of the mandible, on the side of the right ramus. At this period there were four dressings to be done—one in the mouth, one

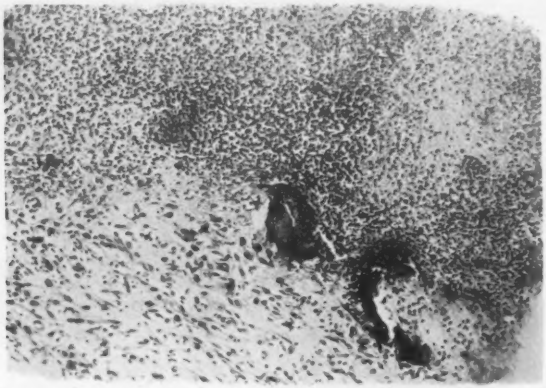

Fig. 2. Chronic purulent osteomyelitis and necrosis of bone.

externally in the back of the jaw, one in the temporal region, and daily dressings of the frontal sinus. The temporal bone needed great attention and care, and Dakin solution irrigations were done three to four times a day, requiring much attention from the nursing force. On April 23, we decided to clean up the temporal bone and the lower jaw, and we also made a large antral opening into the nose. A specimen of the antrum was sent to the laboratory. The jaw was curetted and it looked very much as if a large sequestrum would form, but we decided to give this necrosed portion a chance to drain through the neck opening. All laboratory reports came back: chronic osteomyelitis. In this case, therefore, we can say that all sinuses showed osteomyelitis except the left antrum, which was also not entirely

healthy; it was irrigated but not operated. On Nov. 27, 1925, a submucous resection was done, together with the removal of the agger-nasi process. On Jan. 15, 1926, the patient had a tooth extracted that was lodging in the antrum, the extraction opening up the antrum. The dentist sutured the mucous membrane and later this healed by granulation. On March 1, 1926, a tonsillectomy was done as a further preventative.

It was our fortune in this case to deal with a very willing patient, who was an example of how much a patient can help to work out his own salvation. Serious cases similar to this are fortunately few. I will say, that those who have had such cases under their charge have had a good many unpleasant hours added to their life's history. This patient is now working, but still comes to the clinic; the temporal bone is not completely healed, and he is still unable to open the right lower jaw normally, giving the mouth a crooked appearance, as evidenced by photograph.

The temporal bone infection could be accounted only by pus being pumped up under the fascia from the sphenomaxillary fossa by way of a perforation in the antrum or, what is more plausible, by way of the spreading of the infection by contiguity of the bone through the diploe over to the temporal bone.

We have here a photograph of a pathological slide of antrum wall with a diagnosis of chronic osteomyelitis. But, on the other hand, the lower maxillary report also shows chronic osteomyelitis, verified by X-ray findings.

X-ray report as follows: "Emergency report. Examination shows a roughening in outline of the inferior margin of the body of the mandible on the right side, extending from about the region of the second molar past the angle and about 1 inch up the ramus.

"Multiple irregular areas of rarefaction exist in the cancellous structures, especially prominent just above the angle suggesting an osteomyelitis.

"There is considerable pericemental retraction with evidence of abscesses at the apices of the first lower right molar."

It is hard to understand how several parts of the head could be affected with the same pathology at the very same time, and the whole process starting with the pain on the face. It is our belief that the nose and sinuses infection were the primary cause and the osteomyelitis spread rapidly by contiguity or by way of the blood stream to the adjacent tissues.

Diffuse osteomyelitis of the flat bones of the head, according to Hajek, is one of the worst complications of sinus infection; and is similar in its course to traumatic or middle ear osteomyelitis infec-

tion, and is to be distinguished from the circumscribed type. According to Shilling, Ropke and Luc an acute or chronic purulent infection spreads diffusely outside of the frontal sinus boundary line, or the antrum, with formation of subdural or extradural abscess; it spreads either by contiguity or by the diploic veins. The suture lines do not interfere with the spreading of the infection by either route. According to Ropke, nine out of sixteen cases show that the diploic veins were the cause of the spreading of the infection as shown in pathological specimens. Such pathological specimens of the veins look dull colored with punctate purulent processes. The younger people are especially predisposed to this disease, because the diploe are larger (after Hajek).

In the case reported no doubt there was thrombosis and phlebitis of the multitude of veins in the sphenomaxillary fossa and the infection was also possibly carried along the lymphatics, causing, first, a periostitis, and then, an asteomyelitis. This case is one in which the osteomyelitis developed prior to the operation and shows that operators are apt to take greater blame than is necessary for bad postoperative results, when such complications develop after operation, as is sometimes the case.

I have particularly in mind a case of one of my best friends, a very good operator who had the misfortune to have this process start from a simple septum operation and extending to the maxillary, palate, cribriform plate, and finally to the brain, with fatal result. Hajek particularly emphasizes this point; the end result is generally a pyemic or a septicemic infection with a protracted course, with relatively fair intermissions, either self-limiting or helped by therapeutic measures, but generally in frontal sinus disease the process ends with cerebral complications, thrombosis of the longitudinal sinus or leptomeningitis, with resulting abscess of the brain. This last occurrence I observed in a very severe case from a frontal sinus infection in one of the best reputed hospitals in this city, with all due care given to the patient; death was due to an unusually large cerebral abscess.

*Case 2: Bilateral neuroretinitis following sphenoethmoidal disease: Operation:* The patient, J. O., was sent to the clinic by Dr. McDonald. He gave the following history: He had been losing eyesight for nearly three years, the left eye being affected first and the right eye soon after; he had had headaches for a long time previous, but never over the bridge of the nose nor in the back of the vortex of the skull. Occasional sore throat, but never fever. He had had eye trouble before coming to this country. He had been married twenty-three years, had nine children living and two dead. In July, 1925,

he went to a hospital in Brooklyn for two months, where his eyes were treated but no examination of the sinuses was made. He was later treated by two other physicians. He went to Bellevue, where the nose was examined and operation advised. He then went to Dr. McDonald, who referred the case to the New York Eye and Ear Hospital, and subsequently referred it to the New York Polyclinic Hospital.

His symptoms at the time of his admission to the clinic were: Pain over the eyebrows, but not at the root of the nose, most severe in the morning; pain in the eyes. He complained that he could not see well and he had occasional sore throat. The Wassermann reaction was negative; the urine negative.

The X-ray report was as follows: Frontal sinus partly occluded; the left sinus clear; the ethmoids and sphenoids clear; the right antrum sclerosed; the sella turcica is displaced backward, indicating an enlargement of the pituitary gland; the left antrum probably clear. Our own interpretation of the X-ray findings indicated an involvement of the sphenoethmoidal sinus, so we decided to operate on Nov. 23, 1925. At the examination we found an obstruction in both middle meati, hyperplastic condition of the ethmoids on both sides, some pus in the right, none in the left; evidence of some operative attempts on both ethmoids; scanty lateral suppuration in the nasopharynx.

*An ethmoidectomy and sphenoidectomy on the right side was done.* A very large amount of pus came out, especially from the sphenoid. A left sphenoethmoidectomy was done later, Feb. 1, 1926. Bacteriological examination showed streptococcus and staphylococcus albus on both sides.

The examination of the eyes on July 21, 1925, by Dr. McD., showed vision to be 10/200 in each eye, but this was reduced later to vision of fingers at 2 feet; so we can readily see that the vision was constantly failing at the time the patient presented himself at the clinic. Examination of the fundus prior to operation showed the same condition as reported by Dr. McD., a neuroretinitis hemorrhagica. At present Dr. McD. reports that his eyes are improving and vision is 20/200 in each eye. The fundus looks better, the neuroretinitis diminishing and the hemorrhage absorbing. In this case the diagnosis of sphenoethmoidal disease could be made definitely from the operative findings, the large amount of pus and the virulent organisms present.

The X-ray, while not definite as to the sinuses, shows an enlargement of the sella turcica. The vision improved soon after the opera-

tion and keeps on improving, although slowly, due to the fact that the condition was chronic. Whether it will ever go nearer to normal is problematical. Operation was necessary in order to save the eyesight. Other causes may be contributory to the visual failure, such as infected teeth, intestinal infection, or the pituitary disease, with this structure, the importance of sphenoid disease is even greater.

This case emphasizes the importance of early recognition of sphenoethmoidal disease in the presence of failing vision.

*Case 3; Early orbital periostitis and cellulitis in acute frontal sinusitis: radical Killian operation:* The patient, O M., age 20 years, was admitted to the hospital March 17, 1925. She had had neuralgia for three months. Two days before she came to the hospital she had fever, headache, pain and swelling over the left eye so that she was hardly able to open it. Inspection showed marked eccyhmosis and edema of the upper lid. There was no history of any discharge of pus from the nose, but the patient had been previously treated for neuralgia.

Objective examination showed: Tenderness over Ewing's point; high deviated septum to the left, no purulent discharge. The mucous membrane over the septum and lateral wall was thickened and edematous. Transillumination of the left frontal sinus showed some involvement. The X-ray showed cloudiness of both frontal sinuses, most marked on the left side. On admission the patient had a temperature of about 100° F., but Dr. L. said it had been 103.°

The following morning the patient was prepared for operation; March 18, 1926, a radical Killian was done. The left frontal sinus was found extending way over to the right; there was one large accessory septum extending from the root of the true septum, almost dividing the sinus in two. The radical Killian operation done included the anterior wall, orbital wall and part of the frontal process of the maxillary. The pulley of the superior oblique was sacrificed for room, the supraorbital bridge was left some anterior ethmoidal cells were also removed, and the ostium curetted. The mucous membrane edematous and acutely inflamed, filling the whole sinus. There were signs of slight necrosis of the posterior wall and orbital wall. The wound was packed into the nose and dressing applied as indicated for the radical Killian.

After operation there was very little reaction and no marked deficiency of the superior oblique muscle. There was some slight suppuration from the periosteum and muscular tissues, which kept up for two weeks, but is gradually disappearing. At the present there is only a slight tenderness, which is growing less; otherwise the patient is feeling well, with no headaches and no discomfort. Ten

days after the Killian operation, the septum operation was done as there was no time previously to do the same, in face of complications present.

We present this case as one of subacute sinusitis of a duration of about three months with a history of headaches and neuralgia, misleading neuralgia, as there was no discharge of pus from the nose even at the time when the patient came to the hospital and already had an eccyhmosis and edema of the upper lid. This case was a true case of closed empyema of the frontal sinus of the most dangerous type. The mucous membrane was so edematous that it practically filled the entire sinus. There was an acute exacerbation of two days' duration and we found the roof of the orbit involved in a type of inflammation that occasionally breaks into the brain before there is any sign in the eye, and causes meningitis, intradural or extradural abscess or brain abscess, with no outward symptoms.

338 West Twenty-ninth Street.

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## EXPERIENCES WITH THE DOWLING TREATMENT; IN EAR, NOSE AND THROAT DISEASES.

DR. SAUL KNOPF, New York.

I present two patients who have had a chronic purulent ethmoiditis, one with an exacerbation of an acute ethmoiditis and acute frontal sinusitis. Both have had a laryngitis sicca. The first one, who has had the exacerbation of ethmoiditis and frontal sinusitis, has been treated by the Dowling method only, with complete relief of pain, discharge and laryngitis. The other patient, with the chronic ethmoiditis and laryngitis sicca, had to have the larynx treated with injections of oil. She also has had complete relief of the purulent discharge and notwithstanding a deviated septum, relief of nasal obstruction.

I have also had a series of other cases which I could not present this evening, although I requested them to come, where the patients have had relief from catarrhal otitis media without tubal inflation; and others with acute antrum infections where they have had relief without puncture of the antra. It may be of interest to describe the treatment briefly.

*Read before the New York Academy of Medicine, Section on Laryngology and Rhinology, May 26, 1926.

It consists of the application of a strip of cotton saturated with a colloidal silver solution (I have used 10 per cent argyrol), into the sphenoidal and ethmoidal recesses, and one end inserted far forward under the middle turbinate with the object of taking care of the frontal duct. It seems that the action of this method of treatment is to deplete the tissues, not only the mucous membrane, but the turbinate tissue also. By keeping this cotton in for twenty minutes to half an hour a profuse discharge occurs, following which they seem to have relief of the turgescence and relief of the pain, if it is an an acute condition; and after a number of treatments for two or three weeks they seem to have relief of the purulent condition, if it is a chronic ethmoiditis. I have tried to treat some of the chronic antrums with the Dowling treatment, but without avail. It is not a panacea, but it shows what can be done with that type of case which you have to treat conservatively where extensive operative measures are for some reason contraindicated, particularly for the chronic ethmoidal infections. I have treated many cases of post-nasal discharge where I have found no evidence of infection in the ethmoids, sphenoids or antra. Many of these patients have had great relief. I have also found that a number of cases of catarrhal otitis media with a reduction in hearing and buzzing noises get relief without tubal inflation. I have used the Dowling method in preoperative treatment for septum operation. I have found that I do not have to pack them following the septum operation and that they do not bleed as much as if they were packed, and the post-operative healing is more rapid; the turgescence is not present, and breathing is restored to normal more rapidly than in many cases that have had packing and no preoperative treatment. I have also treated patients who have had recent ethmoid and sphenoid operations, and found that granulation tissue is prevented and the healing is more rapid, and the comfort of the patient is increased. I have had success with so many of these cases that I feel it would be an advantage if others would try out this treatment. I am sure they would be very much pleased with the results; especially they would find that following septum resections packing the nose would be unnecessary, thus eliminating the tremendous discomforts of headache, forced mouth breathing, etc., and even lessening the amount of bleeding, post-operative swelling and delayed healing.

17 East Thirty-eighth Street.

# THE RELATIONSHIP OF ACUTE AND CHRONIC PARA-NASAL SINUS DISEASE TO SYSTEMIC CONDITIONS IN INFANTS AND YOUNG CHILDREN.*

Dr. A. J. Cone, Iowa City, Iowa.

The relationship existing between paranasal sinus disease and the various systemic diseases of infancy and childhood has been noted by pediatricians as well as by rhinolaryngologists. The published reports have been largely confined to isolated groups of cases, for example, bronchiectasis, asthma, arthritis, etc. Because of the diverse nature of these reports it is difficult to correlate the frequency and the importance of this relationship. The vicious cycle of sinus disease causing systemic infection with lowering or resistance, thereby producing a predisposition for continued sinus infection, is a problem requiring the study of both pediatrician and head specialist.

The close co-operation existing between the various departments of such an institution as the University Hospital has made possible the careful study of these cases from the viewpoint of both the general medical aspect as well as that of the specialist. The very nature of the complicated conditions seen in these children make it essential that the recommendations of the pediatrician, who is thoroughly conversant with the general well being of the child, shall take precedence over that of the head specialist. On the other hand, the frequency with which the general conditions are alleviated after treatment by the head specialist, in cases where the efforts of the pediatrician have proved futile, make the recommendations of the head specialist of no less value than those of the pediatrician.

It has been thought desirable in the preparation of this paper to limit the study to conditions found in children under 11 years, who have presented themselves for treatment during the current year. The greatest number of the group, 56, were referred to this service by the department of pediatrics. The remainder were referred from orthopedics, 3, or admitted directly to this service with a systemic diagnosis made before hospitalization, 12. It was found that a child was entered often with more than one systemic condition. The most frequent diagnosis on entrance is shown as follows:

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*From the Department of Head Specialties, State University of Iowa.

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Arthritis, 7; eczema, 5; asthma, 5; chorea, 6; bronchiectasis, 7; malnutrition, 9; anhydremia, 6; nephritis, 3; nephrosis, 3; pyelitis, 5; celiac disease, 1; chronic ulcerative colitis, 2; purpura hemorrhagica, 1; and a group of miscellaneous cases referred because of fever, vomiting, cough and sputum, 4; headache, 2, suspected brain tumor in one; and diabetes, 5.

The relationship between infected lymphoid tissue in the naso- and oropharynx and certain systemic conditions is often definite, but in this series of cases the histories showed that twenty-nine cases had had the tonsils and adenoids removed without relief of the systemic condition. In thirty-one cases the tonsils and adenoids were removed at the time of the sinus examination and treatment.

The usual routine for diagnosis included anterior rhinoscopy, examination with the nasopharyngoscope, and Roentgenograms of sinuses. The examination with the nasopharyngoscope as a rule was done under ethylene anesthesia, or in cases where tonsils and adenoids were removed, was done under chloroform ether anesthesia just prior to the operative work. A short chloroform anesthesia was used to obtain Roentgenograms in cases where good plates could not be secured otherwise.

Aspiration of the maxillary sinuses was done in fifty-six cases. In forty-one cases the findings warranted making an opening with a rasp into one or both maxillary sinuses, the approach being under the inferior turbinate. In the remaining fifteen cases instillation of 10 per cent argyrol with the removal of the tonsils and adenoids was considered sufficient. Large openings under the inferior turbinates were necessary in two cases, bilateral Sluder operation on ethmoids and sphenoids in three, and unilateral in three.

The bacteriological reports on aspirations and washings of the maxillary sinuses showed hemolytic streptococci in two cases, long chained streptococci in one, short chained streptococci in two, streptococcus viridans in three gram positive cocci in two, gram positive bacilli in one, and staphlococci in nine. This examination might be considered disappointing since the percentage of positive findings is small, but it should be remembered that the pathology in the sinuses is usually submucosal and the principal changes are hyperplastic rather than suppurative, and bacteriological reports on smears and cultures may often be negative.

The Roentgenogram reports have shown pathology of some degree in all but three cases of chronic suppurative maxillary sinusitis. The extent of the pathology could not be predicted from the Roentgenogram. The main value of the Roentgenogram of sinuses in infants and young children is, as stated by Dean,[1] "to tell whether or not a

given sinus is present and if present, whether on an anatomical basis it has clinical significance."

The examination with the nasopharyngoscope has been a very valuable aid in diagnosis, especially in infants where anterior rhinoscopy gives limited detail and posterior rhinoscopy is practically impossible.

The division of cases according to sinuses involved showed the following: Pansinusitis in ten cases, nine of which were suppurative, eight were bilateral and one unilateral. One was hyperplastic. The maxillary sinuses were involved in twenty-one, and empyema was present in six. The maxillary, ethmoidal and sphenoidal sinuses were all involved in fifteen. The ethmoidal and sphenoidal sinuses alone were involved in six. In the remaining cases the diagnosis was stated as paranasal sinus disease because of circumstances arising so that aspirations of the maxillary sinuses were not considered advisable, were refused, or because of complications, such as contagious diseases, arising.

The report of the cases according to diagnosis is as follows:

ARTHRITIS.

This group is composed of two cases of Still's disease, four cases of chronic deforming arthritis, and one with pain in wrists and a septic temperature. All cases, even the two of Still's disease, have shown marked improvement. They have been under daily observation and the findings are therefore of great value. One case of chronic arthritis has returned to the hospital after a period of six months' improvement with recurrence of joint pains and showing evidence of sinus disease still present. Three of this group required radical surgery. The evisceration of ethmoids was done with immediate definite improvement. In the remainder, removal of tonsils and adenoids with irrigation of maxillary sinuses for a short period has given relief.

The following case is reported in detail to demonstrate the procedure in handling arthritis in children when it is accompanied by sinus infection:

Case M. B., female, age 3 years, entered the Pediatric Service because of swollen joints and failure to gain. The father has pulmonary tuberculosis and the patient had been in close contact with him.

The present illness began in August, 1924, following an acute upper respiratory infection which lasted but five days. The fever continued and joints became involved. On coming under observation, Jan. 18, 1925, the main features were the deforming arthritis, enlarged spleen, pyelitis and marked athrepsia.

Following the removal of the tonsils and adenoids, Sept. 10, 1925, the patient showed some improvement. She returned in November, 1925, and braces were fitted for the hands. She then was permitted to go home, but returned after two months, with joints showing more involvement. The limitation of motion of the wrists and ankles was more marked. They were tender and swollen. There was a generalized lymphadenopathy; the heart and lungs were negative. In February, 1926, there was swelling of each knee, with pain on forced movement. The patient "hobbled" when she walked. An advance of the arthritis in the ankles and wrists was evident. Examination showed a chronic bilateral suppurative ethmoiditis. The maxillary sinuses were clear and aspirations negative. After the nasal examination she returned to the Pediatric Department, with the recommendation that no operative work be done because of the mildness of the sinus infection, unless the pediatricians considered it justifiable because of the severity of the systemic condition. In the course of two weeks the temperature rose; the restriction of motion in both wrists indicated beginning ankylosis. Radical sinus work was advised as a last resort. The patient was returned to this department and the ethmoid sinuses on each side were eviscerated. During the next three weeks she showed definite improvement, but because of evidence of continued infection the maxillary sinuses were re-examined and cultures showed long chained streptococci. An opening was made in each maxillary sinus under the inferior turbinate and the sinuses were treated twice each week with the patient under ethylene anesthesia. She gained 910 grams in the first eighteen days after the treatment was instituted; the joints showed definite return of function and the patient was active and felt well.

A mother's report on another case similarly treated during the past two years in this clinic is of enough value to quote here:

"You will remember me perhaps as the mother of C. M., the little arthritis patient whom you have done such splendid work on in the past few years. She is in fine shape, 100 per cent perfect, we think. She is age 7 years, 49½ inches tall and weight, 59 pounds. With the exception of whooping cough she has had a fine winter. No sign of her old trouble and she is active and healthy looking. I wish you could know how grateful we feel for the work that has been done on C. M. at Iowa City."

The case report gives the best idea of the status of radical operations as conducted in this clinic. Every possible measure was tried before evisceration of ethmoids was performed and then the operation was done only after the urgent recommendations of the pediatricians. The results warrant the procedure.

### CHOLERA INFANTUM.

Jeans and Floyd[2] report a group of cases with "rapid loss of weight, fever, diarrhea, dehydration, and the appearance of intoxication. The intoxication is characterized by drowsiness or stupor and pallor with a grayish hue. In recent years all patients presenting this clinical picture who have come under our observation have had either mastoiditis or paranasal sinusitis. The infection seldom is obvious, while the gastrointestinal symptoms are prominent. The establishment of adequate drainage from the site of infection brings about prompt and complete recovery."

Six cases with the above picture in which paranasal sinus disease was diagnosed, were seen during the course of this study. Four responded to sinus treatment and two died. Necropsy obtained in one showed a unilateral suppurative maxillary sinusitis as the only positive finding. The second fatality followed the development of an acute mastoiditis. The drainage of the maxillary sinus in this case failed to give improvement and the patient died with a general septicemia.

Since these cases have been reported so recently by the above writers, further detail is omitted purposely, and the reader is referred to their report for a more complete description of this type of generalized manifestation.

### BRONCHIECTASIS.

Six cases of bronchiectasis and, in addition, one of acute bronchitis with history of "frequent pneumonia" are included in this study. The latter case demonstrates when best results can be expected from treatment of sinus condition related to nontuberculous lung infection.

Mullin[3] states: "A condition, bronchiectasis, develops inexplicably in a certain number of cases, often with a history of acute bronchitis, a disease nearly everybody has at some time, or of bronchial pneumonia, followed by a chronic cough. Bronchiectasis does not occur in the majority of the cases of chronic bronchitis, and the tendency is to get well unless fostered and fed by a chronic sinus infection."

This writer gives the following classification:

"*1.* Bronchiectasis due to mechanical obstruction. *a.* Foreign bodies in bronchi. *b.* Tumors, including aneurysm.

"*2.* Cases of general 'bronchiolectasis' in young children after acute bronchitis.

"*3.* Cases, especially in infants, where there is bronchial dilatation to compensate for atelectasis.

"*4*. Cases associated with fibroid tuberculosis, or other extensive fibrosis, as after empyema or organizing pneumonia, where there is contraction and compensatory bronchial dilatation. These four groups of known or partially known etiology comprise a minority of the cases of bronchiectasis, and leave a majority to be classed as:

"*5*. Cases attributed to chronic bronchitis or to an acute bronchitis or bronchopneumonia which has left sequelae.

"This fifth group of cases includes all not included in the first four. That is, all the obscure cases. In them the history is often vague and the real cause distinctly hypothetical."

He states further: "The lymph drain age of the antrum is by way of the submaxillary and deep cervical nodes. These, latter in the rabbit are long nodes which take the place of the entire deep chain in man, including the retropharyngeal. From these nodes drainage passes onward by the cervical lymph ducts, the great veins, the right side of the heart and the pulmonary artery to the lungs."

The inhalation route must also be kept in mind. This route would appear to be especially important in suppurative sinus conditions by infecting the bronchi, especially during sleep.

Two of the seven treated in this clinic had been diagnosed previously as tuberculosis. It was not until after patients were admitted to the State Sanitorium for Tuberculosis that this diagnosis was ruled out and a probable diagnosis of nontuberculous lung infection was made. All gave histories of frequent upper respiratory infection. Three dated their trouble to influenza. One had had asthma since 2 years of age, with a history that colds and acute flareups of upper respiratory condition always preceded the attacks of asthma. The Roentgenograms in the seven cases showed blurring of the maxillary sinuses. Bacteriological reports on sinus washings were positive in three, streptococci being found in two, and staphylococci in one. The reports were negative in two. The sinuses were not aspirated in the two remaining cases.

The management of these cases has varied. The one with frequent attacks of acute bronchitis and "frequent pneumonia" had tonsils and adenoids removed, and 10 per cent argyrol instilled into the maxillary sinuses. He was sent home with instructions to drop 5 per cent argyrol in the nose twice each day. The condition has improved and further work on the sinuses has not been indicated. This case falls in the group which Dean[4] describes in the statement "80 per cent of our chronic cases of nasal sinus disease in infants and young children have been cured by the removal of tonsils and adenoids without any further treatment."

The above report is in marked contrast to two advanced cases who have required weekly sinus treatments during the past six months as well as bronchoscopic treatment, with the aspiration of dilated bronchi and injection of lipiodol. These two have responded after prolonged treatment of sinuses and lungs. Every attention, such as special diet, daily nasal irrigation, argyrol drops to the nose, fresh air, sunlight, etc., has been given in the course of treatment. The period of hospitalization and the care required have been long and tedious. Although there appears to be a definite improvement in these cases, the ultimate result with such advanced lung changes cannot be looked upon with promise.

The relation, which has been definitely shown to exist between the sinuses and nontuberculous lung infection, would seem to indicate that the ultimate result will vary directly with the time at which the bronchiectasis is diagnosed and the foci eradicated.

## NEPHRITIS.

The relationship between sinus disease and parenchymatous nephritis or, as it has been called by Epstein, nephrosis, appears definite. Clausen[5] demonstrated that:

"*1.* Such infection was invariably present in each of a series of unselected cases; *2.* exacerbations of the infection were accompanied by exaggeration of the symptoms; *3.* successful treatment of the infection was followed by improvement or cure; *4.* other forms of treatment were of temporary benefit only; *5.* in other forms of nephritis sinusitis is not regularly present. The striking and often permanent relief which followed in every instance in which a definite improvement in the nasal sinus infection could be attained, and the absence of such relief otherwise, lends strong support to the thesis that nasal sinusitis is an important factor in the causation of parenchymatous nephritis. The organism most frequently obtained from the sinuses at operation is staphylococcus aureus or staphylococcus albus."

In conclusion, he stated that *1.* in a series comprising all cases of parenchymatous nephritis seen at the St. Louis Children's Hospital, in a period of three years, nasal sinusitis was invariably present, evidences presented that the sinus infection is an important factor in the causation of this disease."

Of three cases of nephrosis appearing during the period covered by this study, two had chronic suppurative maxillary sinusitis and the third had bilateral suppurative pansinusitis. Staphylococcus albus was obtained from the sinuses in two cases, one of which also had streptococcus viridans. The organism from the third was not re-

corded. Two died while under treatment, one developed mastoiditis with a lateral sinus thrombosis after two weeks of apparent improvement. The second, who had bilateral suppurative pansinusitis, developed septicemia. At the necropsy of the latter much pus was found in the left maxillary sinus. These two cases demonstrate "the susceptibility to infection" which was pointed out by Clausen.[6]

The report of the progress of the third case is as follows:

A girl, age 8 years, entered the Pediatric Service on March 9, 1925, complaining of "kidney trouble." She had developed swelling of eyes and face in February, 1925. About ten days later it was noticed the child was unable to lace her shoes. The edema increased and pitting was noted over the back and shins. On admission to the Pediatric Service a diagnosis of nephrosis was made. After a month of medical management without improvement, the patient was transferred to the Department of Head Specialties for eradication of foci in the upper respiratory tract. The findings were *1.* bilateral chronic empyema of the maxillary sinuses, and *2.* chronic infected faucial tonsils and adenoids.

When operated, thick, heavy, ropelike pus was obtained from both maxillary sinuses. Large openings were made for drainage, and tonsils and adenoids removed.

The culture was reported as staphylococcus albus and streptococcus-viridans. The post-operative treatment was daily suction and irrigation, followed by mercurochrome drops to nose, and special sinus diet, high in fats. Nineteen days after operation the patient was discharged well, and there has been no recurrence after one year.

Hemorrhagic nephritis, as shown by Clausen,[6] presents different findings. One case seen during this period showed on examination, chronically infected tonsils and adenoids and a mild suppurative ethmoiditis and sphenoiditis. The patient improved with the removal of the tonsils and adenoids. The washings of the maxillary sinuses in this case were reported clear and cultures negative. The sinus condition was not considered of primary importance, but rather as associated with the diseased tonsils and adenoids. In nephrosis the sinus disease is the essential factor. In hemorrhagic nephritis diseased tonsils and adenoids appear to be of greater importance.

### MISCELLANEOUS.

Four cases were referred because of unexplained temperature. In three, it was associated with cough and sputum, and in one, with repeated emesis. Tuberculosis had been considered as a diagnosis in two of the cases, both of which were found to have bilateral suppurative maxillary sinusitis. The tonsils and adenoids had previously been removed. Streptococcus viridans was obtained in one

case. The third had, in addition, a subacute ethmoiditis and sphenoiditis. The general condition of the latter improved after two months of sinus treatment. When seen seven months later the patient was well. The fourth case entered because of temperature and frequent attacks of vomiting. Bilateral suppurative maxillary sinusitis and chronically infected tonsils and adenoids were found. The tonsils and adenoids were removed and each maxillary sinus was rasped, with improvement and no further treatment was necessary

PYELITIS.

Five cases of pyelitis were examined for foci. Chronic suppurative maxillary sinusitis was diagnosed in two, and paranasal sinus disease in the others. With medical management and local nasal treatment they improved. When pyelitis is present there is frequently an upper respiratory infection and the pyelitis fails to improve until the upper respiratory condition is taken care of.

ASTHMA.

Lierle[7] states that "there is in children a type of asthma which has direct relationship to paranasal sinus disease." He has shown that "by treating the paranasal sinus condition in many cases the asthma disappears and in practically every case, is markedly improved. In those cases that are not cured it is found that there is a recurrence of the sinus disease."

In the group studied, five cases of asthma were found to have sinus disease. Definite improvement followed treatment. Frequency of attacks has been diminished in all cases. Two had maxillary involvement alone, two had maxillary with ethmoid and sphenoid involvement, and one had a bilateral pansinusitis. This group is included with the cases of asthma in children reported by Lierle and detail is therefore omitted purposely.

MALNUTRITION.

Nine cases of malnutrition were found to have sinus disease Which condition preceded is questionable. However, with medical management, special diet associated with treatment of sinus condition, improvement was noted in all cases.

The experiments conducted by Daniels[8] demonstrate the relationship between malnutrition and sinus disease. She states:

"Rats fed on diets adequate in all other respects but low in the vitamin A factor develop, in the course of time, infection of the upper respiratory tract. The first symptoms of the dietary deficiency are snuffles, loss of appetite, and failure to gain. These animals invariably die unless appropriate dietary treatment is introduced early in the course of infection. Macroscopic examination of the various

organs of these animals, with the exception of the aural and nasal passages, which have been found filled with pus, shows nothing consistently abnormal. Occasionally the lungs are infected. Often the intestines are filled with gas and greatly distended. Death in these animals seems to be the result of an infection superimposed on tissues which have been altered by the dietary deficiency.

The excessive reaction to infection of the upper respiratory tract (nasal and aural passages) of the artificially-fed baby and the low incidence of such infection amongst breast-fed babies, suggests that in the former case, as in the rats, we are dealing with an infection superimposed on tissues which have been altered by a dietary deficiency."

CHOREA.

Classified in the chorea group were six with sinus disease, two with chronic suppurative maxillary sinusitis, and one with empyema. Two had, in addition, chronic suppurative ethmoiditis and sphenoiditis. One was recorded as paranasal sinus disease and one as chronic suppurative ethmoiditis, bilateral. Two of the six cases had the cardiac manifestations of chorea. McCulloch[9] states "cardiac disease is not a complication of chorea but should be considered a joint result of some focus of infection usually in the nose, the throat, or the paranasal sinuses."

Pesetke[10] states that "if we hope to prevent chorea we must eradicate the foci of infection that initiate the rheumatic syndrome, that is, infected tonsillar ring adenoids, teeth, sinuses and ears. Until more convincing evidence is available the infectious theory of chorea must be accepted as most plausible and probable."

ECZEMA.

Five eczema cases which failed to improve with the usual management were found to have sinus disease. In three of these the observation extended over a long period. Treatment of the sinuses, together with local applications to the skin resulted in marked improvement, but with a discontinuation of either the eczema recurred. One of the eczema group had had asthma. The asthma has not reappeared but the eczema recurs when the sinus treatment is omitted. A second case of eczema had had frequent attacks of bronchitis. Both the eczema and the bronchitis improved with sinus treatment.

HEADACHE.

Two patients had a history of frequent severe headaches. The possibility of brain tumor had been considered in one, but the headaches ceased after removal of adenoids and the institution of local treatment for a chronic suppurative ethmoiditis and sphenoiditis. The second case required evisceration of the ethmoids and sphenoids

and drainage of the maxillary sinus. In both of these cases the relief has been permanent.

### CELIAC DISEASE.

One case of celiac disease, while in the Pediatric Service developed a severe sinus infection with an orbital edema and a temperature of 106.° After evisceration of the ethmoids and drainage of maxillary sinus on the affected side, the edema and fever disappeared rapidly and the patient's general condition improved. Focal infection in this type of case is of extreme interest since the etiology is unknown.

### PURPURA HEMORRHAGICA.

One case of purpura hemorrhagica had chronic suppurative maxillary sinusitis, chronic suppurative ethmoiditis and sphenoiditis, and chronically diseased tonsils and adenoids. The systemic condition improved after treatment of sinuses and removal of tonsils and adenoids.

### CHRONIC ULCERATIVE COLITIS.

There have been two cases of chronic ulcerative colitis in children, age 2 and 10 years. The pediatricians had ruled out to their satisfaction the possibility of specific cause. Both cases gave a history of onset following upper respiratory infection and were, therefore, referred to the Department of Head Specialties for examination for foci. Because of the rarity of this condition, these two cases are reported in greater detail.

*Case 1:* H. B., age 2 years, entered the Pediatric Service complaining of diarrhea of one year's duration. About one year previous to the time of entrance, following a "bad cold," this patient developed diarrhea with blood and mucus in the stools. This condition cleared up under treatment and remained latent for intervals of from a week to a month, but reappeared with seeming increasing severity, the stools being more frequent and containing more blood and mucus. The child was a poorly nourished and developed male, pale, anemic and with flabby muscles. All forms of medical treatment, diet, etc., gave no improvement. The patient continued to lose weight and became progressively weaker. There were numerous food refusals. The condition was aggravated by frequent upper respiratory infections. Two blood transfusions were done because of poor general condition. The patient was referred to the Department of Head Specialties for examination for foci or infection in the upper respiratory tract. The diagnosis was chronic faucial tonsillitis and adenoids, paranasal sinus disease and cervical adenitis. Removal of tonsils and adenoids and treatment of sinuses was advised. This was refused and patient left hospital unimproved.

The definite history of upper respiratory infection is the point of interest in this case.

*Case 2:* J. Y., a white boy, age 10 years, entered Pediatric Service with history essentially the same as Case 1. The onset of the diarrhea followed an "attack of grippe." Specific cause was ruled out. The patient was referred to the Department of Head Specialties for examination for foci. The diagnosis was mildly diseased faucial and pharyngeal tonsils, paranasal sinus disease and cervical adenitis. Operation was recommended. The faucial and pharyngeal tonsils were removed, the maxillary sinuses were aspirated, and because of the evidence of disease an opening was made with a small rasp below the inferior turbinate. Two treatments at an interval of one week showed pus in the maxillary sinuses. At the end of this period the patient left the hospital with no marked improvement in the condition noted.

Helmholz[11] reports five cases and states that the literature has failed to reveal a single article dealing with chronic ulcerative colitis in childhood. In three of the five cases, he reported, there is a history of upper respiratory infection preceding the onset of colitis. In one case "onset followed scarlet fever, complicated by otitis media at age 7 years. The tonsils and adenoids and four carious teeth were removed. These measures seemed to have a definite effect in decrasing the intestinal blood." A second case had reported to the Mayo Clinic for removal of tonsils seven years before "because of repeated attacks of infection in the upper respiratory tract." In a third case bloody diarrhea appeared at age 2½ years. There was the history that "she had had measles, whooping cough, chickenpox, pneumonia at age 2 years." After a quiscence of seven years "she had a return of her old condition with dysentery and a good deal of blood and mucus. There had been no irregularity of the diet and a slight cold was the only premonitory symptom."

It is impossible to draw conclusions from two cases alone. The association of an upper respiratory focus with chronic ulcerative colitis must be considered. The chief point in these two cases was the history of the onset and aggravation of colitis with "bad cold" and "grippe" and the findings of definite paranasal sinus disease.

### DIABETES.

Jeans[12] reported twenty-one cases of diabetes in children in whom a diagnosis of sinus disease had been made in this department. "Eighteen of these cases were operated and sinuses treated. Definite and even marked lessening of the insulin requirement followed in 20 per cent. Stabilization of the insulin requirement was seen in

most of the remainder." This study was undertaken "because under good dietary control the insulin requirement was increasing in many patients out of proportion to the increase in diet."

Five of the above group of cases came in the age and time limit of this study. The most frequent sinus condition found was a chronic suppurative maxillary sinusitis.

## CONCLUSIONS.

Infants and children under age 11 years entering the hospital during the year March 1, 1925, to March 1, 1926, with various systemic conditions, were found frequently to have infections in the upper respiratory tract. In a large number of cases the systemic conditions have been alleviated by removal or treatment of the upper respiratory foci (tonsils, adenoids and paranasal sinuses) alone. Other cases have required combined medical and surgical treatment, neither proving efficacious in itself.

At this time it cannot be proved that paranasal sinus disease is the direct cause of the various systemic conditions, but its relationship must be considered carefully.

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# THE GRADENIGO SYNDROME, WITH THE REPORT OF THREE CASES.*

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Isolated paralysis of the external rectus complicating acute suppuration in the temporal bone had been reported in the literature a number of times prior to Gradenigo's[1] presentation of his syndrome which added to these symptoms head pains of an unusually severe and persistent type.

The original paper, 1904, incorporated case reports of several patients of his own and others collected from the literature. From these, the deduction was made that this triad—acute suppurative otitis media, severe temporoparietal pains and paresis or paralysis of the abducens of the same side—constituted the symptom complex of a defintie clinical entity.

In a further publication, three years later ,the same author tabulated the records of all cases appearing in the literature to that date, fifty-seven in number; to these he added a discussion of eight cases in considerable detail, and a general consideration of the various points involved.

The writer ventures to insert, for the benefit of those who have not read the original, a rather literal translation of Gradenigo's[2] interpretation of the symptoms making up the so-called triad, and, also, the conclusions drawn from his study of the cases mentioned.

"We are dealing, therefore, with fifty-seven cases, of which twenty-four belong to the first, twenty-nine to the second, and only four to the third category."

In seven cases C. O. M. S. was present; the acute inflammations are therefore in the majority: 87 per cent.

The mortality is also very low, for there were only four deaths in fifty-seven cases. In 92 per cent recovery occurs after operation in the region of the mastoid process, or in the cranial cavity, as well as without operation. It can, therefore, be maintained that the disease usually occurs in connection with an acute otitis, and that in the majority of cases the prognosis is favorable.

In fifty-five cases in which the sex is indicated, there are thirty-seven men, 67 per cent, and only eighteen women.

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From the Department of Otolaryngology, Blair Memorial Hospital.

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In forty-nine cases in which the side of the body on which the infection occurred was taken into account, it was twenty-eight times on the right and twenty-one times on the left. The infection, therefore, occurs in a slight majority of cases on the right side, 57 per cent.

In reference to age, the following results are given in fifty cases: Age 1 to 10, 12; 11 to 20, 10; 21 to 30, 12; 31 to 40, 9; 41 to 50, 5; 51 to 60, 0; 61 to 70, 1; above 70 years, 1.

The affection, therefore, occurs in the majority of cases in the first decennium, especially the first and third, which fact coincides in the main with statistics of ear disease.

Let us now examine in detail the several symptoms:

*Acute Purulent Otitis:* Usually there are symptoms of retention of pus in the tympanic cavity, because of a complete lack, or insufficiency, of perforation of the tympanic membrane. In thirty-two cases ,no spontaneous perforation occurred or was very late, or paracentesis was performed, but likewise quite late. The perforation was for the most part too small and insufficient for drainage, so that often an artificial extension of the same was necessary; aside from that, the opening of the tympanic membrane often showed an inclination to close, so that the paracentesis had to be repeated, in one case even five times during the illness.

A noteworthy circumstance to which I would like to call attention, so that others in the future may take notice of the same, is the relatively frequent site of the perforation in the anterior half of the drum, for this, as is well known, occurs rarely in acute inflammation.

In fourteen cases in which the site of the perforation was given by the author with exactness, it was in eight cases in the anterior part of the membrane, five times in the anterior inferior, one time in anterior superior, and two times in the anterior half.

The paracentesis or the extension of the perforation is usually followed immediately by relief of the other important symptoms; that is to say, pain and paralysis. A case of Picks and another of Cozzolino are highly illuminating in this connection.

In the chronic form, which occurs but rarely, and in which we are dealing with acute exacerbation of a chronic condition, the retention of the exudate is brought about through polyps, hardened purulent secretion or cholesteatoma, which stop up the external auditory canal.

INTENSIVE PAIN, ESPECIALLY IN THE TEMPOROPARIETAL REGION OF THE SAME SIDE.

The otitis is accompanied from the beginning by most violent pains, which are continuous, or which disappear for a few days,

after the occurrence of purulent discharge from the external auditory canal. The pain is referred by the patient to the interior of the affected ear, but especially temporoparietally, and at times, also, to the depth of the orbit. The movements of the eye on the side of the affected ear may also be painful. The pain must be differentiated from that which occurs in the case of neuralgia, the pain is distributed along the branches of the fifth nerve and occurs spasmodically. In the case of the distribution spoken of, the pain is intensive and continuous. It is not influenced through antiluetic treatment, as is the case of the pain of syphilis. In contrast to the latter, it shows no greater intensity at night. At times the pain decreases and stops almost entirely, as is the case of ordinary otitis, in the first few days immediately after the appearance of purulent discharge, and does not occur again until after two or three weeks, as a forerunner of the ocular complication.

*Paralysis of the Abducens:* This symptom seems to appear suddenly and unexpectedly: The patient himself notices the diplopia and calls the attention of the physician to it, who recognizes at once a paralysis or paresis of the abducens nerve on the same side as the affected ear as the cause of the diplopia. The physician could most likely recognize the gradual development of the paralysis, if the appearance of paralysis could be foreseen, through a system of examination of the function of the eye muscles. We know of cases in which the slow development of a simple paresis into paralysis could be followed. Usually, there is a recovery from the paralysis, and this also occurs gradually, at times very slowly. The measurements which have been made by Lombard in one of his cases are very instructive.

Paralysis only rarely appears a short time after the beginning of otitis. Usually it is a symptom occurring late in the disease. In thirty-seven cases in which the time of its occurrence could be determined exactly, it occured only three times early, that is from five to ten days after the beginning of the otitis, twenty times after twenty to fifty days, and ten times after forty-two to 50 days. Only in exceptional cases does the paralysis occur after fifty-six days (in six cases).

In conclusion, one can state that it usually occurs a month or a month and a half after the beginning of acute inflammation of the ear.

It has already been said that paralysis ends in recovery in a majority of cases. Its disappearance usually proceeds gradually and slowly, at times very slowly indeed. Cases are known in which traces

of paralysis were still found five months after the occurrence of the disease (Ricci). But these are only exceptional cases; as a rule, the time in which recovery occurs varies between one to three months. It appears that paralysis disappears comparatively quickly in those rare cases in which it occurs early (Baurovicz, beginning on the fifth day, disappearance on the tenth day; Tommiassi, appearing on the seventh day and disappearing on the twentieth day), but this is not the rule, for there are also cases known in which an early appearance of paralysis was followed by a late recovery.

Only in exceptional cases was it observed that nystagmus preceded paralysis, or that it occurred at the same time. There are all possible graduations between paresis and paralysis.

The above mentioned characteristics mark the typical case. From the side of the eye no other symptoms can be found; the reaction of the pupils, the eyeground, the function of all the eye muscles with the exception of the external rectus are normal. The labyrinth also remains unaffected in the acoustic region as well as that of equibirium. The temperature remains normal in typical cases, which are not complicated through the entire course of the disease.

In the second category of cases, with the above mentoined characteristics, come other symptoms which accompany the disease or complications appear. These latter do not seem to stand in any original relation with the paralysis of the nervus abducens, because they are not present in the majority of cases, as we shall see.

The accompanying symptoms as well as these complications complete the clinical picture of the disease.

*Accessory Symptoms:* The symptoms which are mentioned as appearing most frequently in typical cases, next to the three most characteristic symptoms just discussed, indicate an irritation of the meninges, or the existence of an infection in the region of the apex of the pyramid.

From this study he drew the following conclusions: There exists a typical clinical picture which is essentially characterized by an acute purulent inflammation of the middle ear and by intensive pains, especially in the temporoparietal bone region of the diseased side, and also by a paralysis of the abducens of the same side. In exceptional cases the clinical picture can be produced through acute exacerbation of a chronic purulent inflammation of the middle ear. In about half of the cases, accessory symptoms can be present, which depend on damage of the trigeminus and the oculomotorius, or of the cerebral membrane. Complications arise sometimes, such as mastoiditis and circumscribed and restricted extradural lesions on the sigmoid sinus.

Generally a complete recovery takes place, and but seldom does death result, with symptoms of a diffuse purulent leptomeningitis. The pathologicoanatomic process consists in a diffusion of the pus infection of the drum cavity to the pyramidal apex through the peritubal air cells and the carotid canal. The abducens is affected at the apex of the pyramid, close to its passage into the dura mater. We have to deal with a circumscribed osteitis at the pyramidal apex, and eventually with a corresponding pachymentitis. The extradural location of the disease explains its generally favorable course. In individual cases, however, there occurs a circumscribed serous or diffuse purulent leptomeningitis.

"Not all cases of paralysis of the abducens, which occur in the progress of otitis, belong to the described clinical picture. Unquestioned forms of these depend on various pathologic causes. Among those occurring most frequently are the extradural deep abscesses on the roof of the pyramid; which extend to the apex of the same. Also, a diffuse ostemyelitis of the covering of the air chamber of the temporal bone occurs, which reaches the petrous point. Cases of this kind naturally do not belong to this type, and accordingly the prognosis and therapeutics of the same appear different."

Gradenigo's studies brought forth a considerable amount of discussion pro and con, his conclusions finally being both accepted and denied. In the first few years following his original paper, case reports with discussions of the subject were not infrequently to be found in foreign journals, but American and English periodicals were notably free from contributions to the subject.

A diligent search of American literature from 1904 to 1909, inclusive, brought to light three papers reporting cases of the Gradenigo syndrome: Hastings,[3] 1906; Knapp,[4] 1908; the writer,[5] 1909; and three others by Smith,[6] Wilner[7] and Jones,[8] where the association of an isolated palsy of the abducens in the presence of an otogenic infection is mentioned; although Wilner in her case ascribes the paralysis to an influenzal toxic neuritis, Engleton,[9] in discussing Smith's paper, refers to two cases occurring in his own practice. There are doubtless others to be found during this period, appearing under various titles, not indicative of this special lesion or syndrome, which were not unearthed. In 1910 Perkins'[10] classic discussion included an analysis of ninety-five cases, all that had appeared in publications to that date. During the past fourteen years, not a few reported cases with associated observations have appeared in our own special journals, as in those abroad. However, Vogel,[11] in 1921, who appends a bibliography of 129 names to his publication, gives only three American references; nor has the writer been able to find in any

foreign biliography more extended reference to the contributions from this side of the Atlantic.

The pathology underlying the Gradenigo syndrome has been extensively discussed, the major portion of authors agreeing that the anatomic position and relations of the sixth nerve at the apex of the petrous pyramid have much to do with its involvement as an otogenic complication.

Dorello's work, in making plain the details of the anatomy of the abducens at this point, is described by Gradenigo.[2] Wheeler's[12] article discusses the syndrome from the standpoint of the ophthalmologist, and gives beautiful plates depicting the same ground. Vail[13] made dissections of eight cadavers, and drew sketches from these illustrating admirably the formation of Dorello's canal and the various structural relations. Suffice it to note briefly here, that Dorello's canal is a variable sized, somewhat triangular shaped space at the apex of the petrous pyramid, which contains or transmits the sixth nerve, its vessels and the inferior petrosal sinus.

At this point, the abducens is peculiarly liable to compression by inflammatory reaction of any type. However, as to the manner or mode in which the abducens is affected, there has been considerable difference of opinion.

Dorello[15] favors the view of transmission of the tympania infection by way of venous channels to the inferior petrosal sinus, and thence by edema to the region of the sixth nerve with compression in Dorello's canal, the process clearing with the passing away of the aural suppuration. Alt,[16] as late as 1919, insists that a reflex paralysis is the only explanation for that class of cases which give no symptoms of a deep-lying inflammation other than the abducens palsy, and which otherwise appear without symptoms and disappear quickly. He has observed three such cases. However, he believes that cases, apart from these, for the most part are due to local inflammation at the point of the petrous.

American authorities are by no means in agreement as to an exact pathology. A local inflammation of the dura (pachymeningitis) of the Gasserian ganglion and sixth nerve is advanced by Dench[17] for his case.

This is concurred in by Shambaugh[18] and Stickney,[19] Day's[20] four cases all had pneumatic temporal bones. He ascribes the mechanism of the paralysis to an extension of the pus infection to the apical cells, the development of a circumscribed pachy and localized serous meningitis, the latter by hydrostatic pressure affecting the function of the sixth nerve in its course through Dorello's canal. Other authors have mentioned variously serous meningitis, edema of the

brain, inflammatory edema at the petrous tip, extension of inflammatory reaction by way of the superior or inferior petrosal sinus. Page[21] ascribes to the latter mechanism the sixth palsies present in his two cases of jugular bulb thrombosis.

A number of authors believe the condition arises as a toxic neuritis. If by this is meant a specific toxin or poison passing by means of the circulation to the sixth nerve and affecting the nerve structure itself, its etiologic relation is not so clear. This term, however, as stated by Burr,[22] is used somewhat extensively, as well as loosely, where exact diagnosis is in doubt, or, indeed, when no exact knowledge of the point in question exists. He points out that a toxic neuritis is usually bilateral and seldom unilateral, so that, since otogenic abducens palsy is usually monolateral and rarely bilateral, by strict interpretation of the term, toxic neuritis must be of rare occurrence.

Many observers are in accord with Gradenigo and his assumption of a definite clinical entity including the triad of symptoms and the pathologic basis brought forward by him. Quite a group, on the other hand, do not accept this pathology. On the basis of proven findings at autopsy, Gradenigo's opponents have rather the best of the argument, for there have been but few autopsies, and the findings can hardly be considered conclusive, since similar findings are met with in other cases where abducens palsy did not appear.

In so far as one can find in the reports of autopsies in these cases, no histologic study has been made of the diseased bone structure of the pyramid, the findings being purely macroscopic. This is likewise true of the sixth nerve, no report indicating microscopic study of its structure having been found.

The majority of these cases recover, and consequently, opportunity for histologic or even macroscopic study of the abducens is lacking. On the other hand, extensive operative procedures on the petrous pyramid give opportunity for macroscopic investigation of the parts reached, and these have tended to show, in a number of cases, pneumatization of the petrous pyramid to its apex, with involvement of these cells by an extension of the purulent infection from the tympanum.

When violent Gasserian pain and sixth nerve palsy are associated with this pathologic condition ( and such are reported), and no other outstanding symptoms are present, the most reasonable and logical explanation is that the ganglion and nerve are directly affected from the pus process contiguous to them.

While the occurence of the trifacial symptoms in the course of acute otitis seems to point definitely to extension and localization of the suppurative process in or at the tip of the petrous portion of the

temporal bone, an abducens paresis in the course of middle ear suppuration need not necessarily indicate an affection of the apex. It is certain that abducens paresis is often attributable to disease of the apex of the petrous portion. The abducens nerve, like the Gasserian ganglion, is in close relation with the spongy substance of the tip of the pyramid. Isolated abducens paresis is so frequently a symptom of otogenous suppurative or serous meningitis, of brain abscess and sinus thrombosis, that the arbitrary assumption of involvement of the tip of the pyramid does not seem justified. Abducens paresis in the course of otitis is a valuable sign of an affection of the tip of the pyramid only when other factors indicate such a disease. An important indication of this is trifacial neuralgia, which in itself suggests the probable involvement of this point. Abducens paresis can be referred to the tip of the pyramid only when this sign appears simultaneously.[23]

The development of Gasserian pain and abducens palsy after the acute ear suppuration has apparently run its course and healed, has not been easily explained. It is well known, as Ballance[24] states: "The communication between the tympanum and the mastoid cells may become shut off by swelling of the mucous membrane, and the disease may continue to progress in the mastoid when it has already subsided in the tympanum. The writer has seen several cases of acute influenzal otitis, attended by profuse discharge, in which the disease continued to extend to the mastoid after the tympanum had healed. In one case, seen in the fourth week, the tympanum had healed, but the antrum and neighboring mastoid cells were filled with granulation tissue, becoming fibrous, while pus was found around and within the sinus groove. In another case, a boy at school, seen at the end of seven weeks from the onset of symptoms, though the tympanum had quite healed and the mastoid nearly so, pus had passed through the dura and formed a large abscess in the cerebellum."

The otitis which leads to bone disease is not always, in its initial stage, attended by any severe symptoms. "It may run its course with slight, scarcely noticeable pain, and without perforation of the tympanic membrane. In spite of the mild course, the infection may lead to an insidiously spreading inflammation, with bone destruction in any distant cell of the mastoid, which may first manifest itself, months afterwards, by general symptoms and external mastoid signs. The locus of disease may remain completely shut off from the tympanum, or the tympanum may be reinfected from the disease in the bone. A serous exudation is sometimes found in it, in addition to the pus in the bone."

Acute suppurations of the tympanum, when not properly relieved by incision of the tympanic membrane, may give rise to osteomyelitis of the spongy portions of the petrous bone (the bone immediately surrounding the labyrinth, and in the vicinity of the bony portion of the Eustachian tube). When this takes place, the patient is in the greatest danger.[26]

Korner[27] reported the experience in a patient who was operated on too late and who died from purulent meningitis. There was disease in the spongiosa in the petrous as well as extensive destruction of mastoid. This condition can hardly be eradicated at an operation, unless the operation is prepared to sacrifice the labyrinth and the facial nerve.

With these facts in view, the class of cases mentioned above seem somewhat analogous to this so-called latent mastoiditis, but with an exact reversal of the progress. That is to say, the aditus from the beginning becomes impervious to purulent transfer from the tympanum to the antrum and mastoid cells; while the infection extends to the apex through the cells of a largely pneumatized pyramid, but, being slow and insidious in its progress, the tympanic infection heals but later may be reinfected from the infection at the apex. These are the cases which show little or no mastoid involvement when operated upon.

In the slow development, vitally important factors are: *1.* The pathogenic organism. *2.* Favorable anatomic structure of the temporal bone. *3.* Virulence of the organism. *4.* Resistance of the patient.

Time is lacking to go farther than the few points already touched upon. Three cases illustrating three different phases of otogenic disease associated with paralysis of the abducens are added below. The writer is much indebted to Drs. Herbert M. Goddard and Matthew S. Ersner for permission to report Cases 2 and 3.

*Case 1:* Nov. 29, 1907, the writer was called to see T. F. B., white, male, who gave a history of very severe pain affecting the left side of the head for the four preceding days. Temperature 99.3,° pulse 90, respiration 20. Prior to the onset of the pain, which was agonizing at times, he had suffered from a slight head cold. The cold, however, had cleared, and at this time gave no symptom. It is noteworthy that at no time had there been any pain whatever in the ear, and, although impairment of hearing was marked, the patient had not noted it until his attention was called by examination. Hearing was reduced to C. V. at 10 feet, Weber to the left; Schwabach lengthened, and Rinné negative.

Inspection showed an approximately normal external canal. The tympanic membrane, however, was dull, thickened, and showed marked bulging. Incision of the membrane was followed by free purulent discharge. The pain was relieved by the flow of pus, which continued free for three days, when pain again became severe, coincident with a decrease in the quantity of purulent discharge. A second incision of the tympanic membrane became necessary twelve hours later. Again, the purulent flow was quite free, for three days, and the patient was free of pain. This was followed by a considerable decrease in the amount of pus, and an immediate increase of pain. The membrane was again incised, with an increased flow of pus and similar easing of pain. At this time, there was some mastoid tenderness, which gradually decreased and passed away in several days. Temperature during this period had varied from 99° to 100.°

The purulent discharge was very free for another week, and then began to gradually lessen, but without return of pain. On Dec. 17 the patient complained of double vision. Examination showed homomynous diplopia, the separation of images increased on looking to the left—a paresis of the left externus; temperature, pulse and respiration at this time normal.

The next morning the paralysis was complete. This was shown by a marked convergent squint, accompanied by annoying diplopia and vertigo. The vertigo was promptly relieved by closure of the affected eye, thus indicating that it was due to diplopia and muscle paralysis, and not to an intracranial complication. Further, the left eye could not be rotated externally beyond the midline. An added complication, occurring simultaneously with the complete palsy of the muscle, was a polyarthritis, accompanied by a rise of temperature.

*Examination of Eyes:* Movements of the lids of both eyes normal; considerable injection of the conjunctiva of the left eyeball. Pupil of each eye, 2.5 m.m., reacted freely and equally to left and center. The media was clear, discs clearly outlined, and no evidence of papilledema or gross lesion of the fundi, V.=20/15—.02.

Ocular movements were unaffected except in the field of the left externus. Pain was elicited by pressure over the area of the affected muscle and by ocular movement, especially by a strong effort at rotation toward the affected side. Bacteriologic examination at this time showed streptococci and staphylococci, streptococci predominating. No lumbar puncture was done or X-ray study made at this time. A skiagram taken recently revealed a pneumatic mastoid of very extensive development.

The purulent discharge ceased within ten days, and the arthritis improved more rapidly than the palsy. By Jan. 18, 1908, no diplopia could be elicited by extended ocular rotation to the left, so that all symptoms of the paralysis had cleared. There has been no recurrence.

*Comment:* 1. The onset of severe left head pain was the first symptom to be noted. The pain was relieved by drainage of pus and recurred with retention.

2. The abducens palsy appeared three weeks after the onset of the otitis, when the disease was on the wane, and it finally disappeared thirty-two days after its appearance.

3. The complicating polyarthritis arose coincidently with the palsy, but healed at least two weeks earlier.

4. There were definite signs of local inflammatory reaction about the affected muscle.

*Case 2* (Courtesy of Dr. H. M. Goddard): C. R., male, white, age 16 years. Chief complaint, pain and loss of hearing in right ear. Past medical history negative, except for influenza during the recent epidemic, and recent night sweats, loss of weight and strength.

*History of Present Illness:* Aug. 2, 1914, onset of acute otitis with high fever, the sequence of a sore throat which had healed in one week before. The following day spontaneous discharge occurred, and two days later he noted that he was entirely deaf.

*Physical Examination:* Aug. 14, 1924, on admission to the hospital, negative, except for discharge from the ear. The tympanic membrane showed a red polypoid mass at its posterior superior aspect, a small perforation beneath, canal normal. Nasal examination negative. Aug. 14, culture from throat showed pneumococci, staphylococci and streptococci. Culture of pus from right ear showed staphylococcu salbus. Aug. 21, the discharge had almost ceased. At this time a complete sixth nerve paralysis associated with a severe periorbital and suboccipital neuralgia developed. The eye grounds were negative. X-ray of mastoid practically negative. Neurologic examination negative, except for sixth nerve palsy.

Aug. 27, a simple mastoidectomy was performed, and very little pus found in the antrum and subantral cells. Polypoid mass of the tympanic membrane removed. Following the operation the pain decreased, the ear drained profusely at first, later decreased, but the paralysis remained constant. On Sept. 3, twelve days after the mastoidectomy, the patient had the first symptoms of fulminating meningitis which resulted in his death twenty-six hours later. Autopsy was refused. He ran a light evening temperature throughout his illness until meningitis developed. Pulse rate, average 72; respiration

20. Urine was negative throughout. Blood count: red cells, 4,000,000; white cells, 13,900; polys., 74 per cent.

*Case 3* (Courtesy of Dr. M. S. Ersner): H. W., age 17 months. Acute bilateral mastoiditis, March 13, 1924.

Patient entered hospital on March 13, 1924. Family and previous history negative. Present condition started several weeks ago with pain and discharge from both ears. Mother also noticed simultaneously that one eye turned in.

*Examination* Right: *1.* Profuse creamy discharge. *2.* Sagging of posterior superior canal wall assuming nipple-like protrusion. *3.* Folds more prominent and slightly thickened. Slight protrusion auricle.

Left: *1.* Profuse purulent creamy discharge. *2.* Sagging of posterior superior canal wall. *3.* Folds silghtly lifted with lower fold smoothed out. *4.* Urine negative. Occasional leucocytes and squamous epithelial cells. *5.* Blood: 3,650,000 10,100; 68 per cent hemog.; 65 per cent small lymph.; 35 per cent polym.; 1 per cent eosin. *6.* X-ray: no appreciable difference between the right and left mastoid processes. Left side looks definitely normal. The semicircular canals clearly visualized. There is a faint suspicion of infection in the posterior cells on the right side. This evidence is not sufficient to be regarded with much weight. *7.* Eye: slight veiling of the edges of the disc. Apparent weakness of the left external rectus muscle, March 13. March 16, no evidence of intracranial pressure.

*Operation:* March 15, blood clot closure with drain. Right side: *1.* Periosteum stripped easily except at the bottom. *2.* Cortex slightly roughened and found thick. *3.* Cavity under the cortex filled with free pus. *4.* Involvement of the zygomatic cells. Culture: streptococcus.

Left side: *1.* Periosteum stripped easily. *2.* Cortex moderately thick. *3.* Cavity under cortex filled with free pus. Culture: no growth.

*Post-operative Period:* March 18, removed stitches and inserted gauze drain. Drainage abundant. March 19, wounds draining freely, also considerable discharge from ear. March 20, right wound wide open, left wound coated in upper half. Good drainage. March 27, temperature normal, wounds granulated and nearly closed, only slight drainage. Both ears dry. Drums assuming normal grayish color. Weakness of external rectus disappeared and no strabismus can now be detected. Discharged to be cared for by family physician.

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CASE REPORTS.

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3. M. D. ERSNER, Philadelphia, Pa.

## FULMINATING MASTOIDITIS.*

Dr. Harold Hays, New York.

No more difficult problem confronts the otologist than the determination of the exact time to operate for acute mastoiditis. It is never a question of the involvement of the mastoid bone; it is often a question as to whether the patient cannot get along without a surgical procedure. It has, not rarely, been my experience to see a really sick patient, decide that within twenty-four hours I would be forced to open the mastoid bone and then, for no known reason, find the patient very much better within those twenty-four hours and see him eventually get well without an operation.

I have felt for years that the keynote to success in mastoid surgery depended a great deal upon conservatism. Patients who can be tided over the acute stage will often withstand an operation better. Moreover, with watchful waiting, a certain amount of attenuation of the bacteria will often take place. In the majority of cases, one feels more than justified in waiting at least four to five days before operating, even when there is very acute tenderness evident over the mastoid bone. In spite of this variable ruling, within the past two years I have seen three children with symptoms and signs of mastoiditis which made it imperative to perform an operation within twenty-four hours after the onset of the acute symptoms. Because such cases are so exceptional and because in at least two of the cases delay may possibly have meant a fatal ending, I take this opportunity to present them to you.

*Case 1:* About two years ago, I was called in consultation to see a child age 5 years, who complained of slight pain in the left ear and who was running a temperature up to 105.° Examination showed a dusky red drum which was bulging. A paracentesis was performed. There was a slight discharge of blood. Within a few hours, a tenderness developed over the mastoid bone, the temperature still remained high, the child became semidelirious. The discharge from the canal had ceased. Examination at that time showed a thick exudate over the membrana tympani. When this was wiped away, the pulsating edges of the incision could be seen. Even with suction no discharge from the middle ear could be obtained. The condition

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remaining the same for twelve hours, Dr. Robert Lewis was called in consultation. He agreed with me that immediate operation should be performed. On removing the cortex of the mastoid bone, one entered a cavity filled with thick pus. Almost all the cells were destroyed and a large part of the sinus was uncovered. After thorough exenteration, the wound was closed except at the lower angle. On the following day, the temperature began to recede and at the end of ten days the child was perfectly well. A culture of the pus showed a streptococcus hemolyticus.

*Case 2:* About three weeks ago, I was called one morning to see a child of four who was running a rather high temperature and who complained of pain in his left ear. On examination, I found a bulging membrana tympani which was immediately incised. Within a few hours, marked tenderness developed over the entire mastoid bone. There was practically no discharge from the canal. As in the former case, one could see a thick exudate over the drum which, on removal, showed a large pulsating incision sufficiently large for drainage. Finding the symptoms were the same on the following day, Dr. Wendell C. Phillips saw the case with me and agreed that an immediate operation should be performed. Here again we found complete destruction of all the mastoid cells with an exposure of the dura of at least 1 sq. c.m. The wound was almost completely closed after operation and within two weeks the child had completely recovered. The organsim responsible was the streptococcus hemolyticus.

*Case 3:* A child, age 14 months, was recently seen by me. He had been suffering from a mild measles, from which he had almost recovered. His temperature was 104.° Examination showed both eardrums bulging. There was a slight edema both in front and behind the left ear which I considered to be due to some enlarged cervical glands. Both eardrums were incised. There was very little discharge. At the end of twenty-four hours, the physician in charge informed me that the child was extremely ill and that the ear condition did not seem to be any better. In fact there seemed to be more edema behind the left ear. I had the child brought to the hospital for better examination. In this short space of time, definite symptoms of mastoiditis had developed and so, within a few hours, the child was placed on the operating table. As soon as the primary incision was made, it was evident that a perforation of the cortex had taken place. The mastoid process was thoroughly cleaned out. No vital parts had become exposed. The offending organism was the streptococcus hemolyticus.

These three cases are worthy of serious consideration. In two of them vital parts had become exposed within twenty-four hours after

the drum had been opened. All of them have certain features in common. In each case there was a rapid onset of symptoms. In each case there was no visible discharge from the middle ear. Examination showed a membranous exudate over the drum which was diphtheritic in character. Even with a large opening in the drum, there was practically no discharge. The acute tenderness over the mastoid bone merely added to the evidence that a fulminating process was going on. In all of the cases, the same organism was at fault. In two of the cases, rapid recovery took place, and I have no doubt that the third case will do just as well.

How can we account for the rapidity of these symptoms? How can we account for the fact that there was little discharge after the incisions in the drum were made? It is my opinion that each of these patients had a large attic and antrum so that the mastoid process was immediately infected at the time of the middle ear infection and that the mucosa became so swollen that the mastoid cells became shut off. This would mean that there was no opportunity for proper drainage. We therefore had in each case an empyema of the mastoid which, in the event that the organism was a virulent one, meant rapid destruction of the cells. This reasoning also accounts for the small amount of discharge, but does not account for the character of the discharge which, as I have stated, was membranous. Perhaps this was caused by the admixture of the elements from the canal itself.

My main excuse for bringing these cases to your attention is that, even with the greatest conservatism, one may find that certain cases occur in which it is necessary to perform a mastoid operation at the earliest possible moment. There is little question in my mind that a diseased condition of the mastoid cells was present in each case before the opening in the drum had been made.

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# PRIMARY JUGULAR BULB THROMBOSIS WITH NUMEROUS METASTATIC INFECTIONS; OPERATION; RECOVERY.*

DRS. HENRY S. WIEDER and WILLIAM BATES, Philadelphia.

Thrombosis of the lateral sinus as a complication of mastoiditis secondary to otitis media is relatively common so that its recognition is comparatively easy and the success attending the early treatment very encouraging. It is, however, much more difficult to locate the source of septic symptoms in the presence of a simple otitis media with no mastoid irritation, no sagging of the posterior superior wall of the external auditory canal, and none of the other signs of a particularly threatening ear condition.

McKernon, in 1904 and 1905, called attention to a syndrome that in young children especially almost invariably points to primary thrombosis of the jugular bulb. In this syndrome the history is usually one of an acute otitis media running an apparently normal course. Suddenly there is an unaccountable rise of temperature of 4° or 5° within an hour or two. In young children there is usually no chill, but almost always cold hands and feet. The rise is followed by fretfulness and then drowsiness, with rapid pulse and respirations. After a few hours the temperature drops just as suddenly to near or below normal.

The leucocyte count is usually high, being commonly around 20,000, with a high percentage of polymorphonuclear cells, commonly 85 to 90 per cent. The condition of the ear is the misleading part of the syndrome, since it shows no evidence locally of serious trouble, there being no sagging of the posterior superior wall, no pouting, pulsating perforations nor any mastoid tenderness.

Another point which makes it difficult to arrive at a diagnosis of so serious a condition is the feeling of absolute well being that characterizes the periods of remission of temperature. The child is usually playful and hungry and is with difficulty restrained to bed so that physician and parents alike are slow to be convinced of the necessity of early operation to avoid an eventually fatal outcome.

Cultures from the middle ear are valuable only in helping to point out which ear, in a double otitis, may be the offending one, since its bacteriology will correspond with the bacteriology of the blood stream. The explanation for the condition, especially in young children, is the extreme parchment-like thinness of the partition separating the jugular bulb from the middle ear or an actual dehiscence in

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the bone. That this same condition exists in adults is attested by the fact that a number of cases have been reported in which primary jugular thrombosis has been found complicating otitis media.

Fraser reports a case occurring in a female, age 41 years, in which the infection had gone so far that previous to operation pressure over the jugular vein caused an increased flow of pus from the ear.

Potts reported two cases, one in a child, age 7 years, the other in a young woman, age 17 years, which paralleled in very many respects the case reported in this paper.

Ginsberg also has reported two cases, one age 8 years, and the other, age 19 years.

The case we desire to report illustrates the occurrence of the condition in adults.

L. D., male, colored, age 26 years, with negative family and previous ear history, was admitted to the ear service of Dr. Walter Roberts in the Polyclinic Hospital, March 25, 1925. He gave a history of having had a cold two or three weeks previously, during which he developed pain in and discharge from the right ear. After a few days the discharge almost ceased, but was followed by marked pain and some diffuse swelling of the right side of the neck. It was in this condition that he was admitted to the hospital.

His temperature was 101⅗,° pulse 100, respiration 32. He was a robust looking adult, colored male, on whom a general physical examination was negative with the exception of some fullness and tenderness without brawniness of the right side of the neck. His pharynx and throat were red and markedly inflamed and the right ear showed a perforation of the tympanic membrane with a small amount of discharge. There was no sagging of the posterior superior canal wall, no pulsation and almost no tenderness over the mastoid process.

The patient was put on light diet and the usual care for otitis media with magnesium sulphate compresses to the neck. As he had been running an irregular temperature since admission, reaching 105⅗° on March 27, and in view of a leucocyte count of 19,750 and a somewhat doubtful X-ray report, it was determined to perform a mastoidectomy, as it was thought that the patient might be developing a Bezold's abscess, which would account for the high fever and swelling of the neck without much tenderness over the mastoid process.

Accordingly, on March 28, one of us (H. S. W.) performed a simple mastoidectomy. Much to his chagrin, we found a normal mastoid process with merely some pus in the antrum. No pus was

found in the neck and there was no fistula leading into the neck. The lateral sinus was exposed high up near the antrum and appeared to be perfectly normal in color and to the touch. Drainage was introduced and the patient returned to bed.

The operation did not seem to relieve the condition and the temperature became possibly more irregular and septic in type. His first chill appeared March 30. Blood culture was reported positive for streptococcus hemolyticus on March 31. Daily intravenous injections of 20 c.c. concentrated Pregl's iodin were ordered.

As the condition remained stationary it was felt that there must be a hidden focus in the jugular bulb, the elimination of which would be essential to the recovery of the patient. Accordingly, one of us (H. S. W.), with Dr. Walter Roberts, on April 2, 1925, tied off the jugular vein, which was totally collapsed. The mastoid wound was then reopened and the lateral sinus widely exposed and incised. Blood flowed from the upper end, but down toward the bulb a well organized clot was found. This was gently curetted out and the wound packed and drained. Rubber drainage was also introduced into the wound in the neck.

The patient stood the operation fairly well. The injections of Pregl's iodin and enteroclysis were continued, but the temperature remained septic in type and the patient developed pain in the knee, both elbows and in the right sacroiliac joint. His blood culture continued positive. The case was referred to Dr. J. B. Carnett's service for advice and treatment.

Accordingly the other writer (W. B.) saw the patient for the first time on April 5, 1925, when he found a fluctuating mass over the right sacroiliac joint, both elbows and right knee. These he opened on April 7, 1925. They yielded a straw colored fluid which on culture showed streptococcus hemolyticus. In spite of drainage the temperature continued with negative blood cultures. The right knee did not improve properly, so a Willm's operation was performed. This consists of wide incisions on both sides of the knee into the joint, followed by periodic exercise of the joint to expel contained pus.

The temperature then dropped and the patient improved, but due to a mechanical exerciser which was arranged for the knee joint, he developed in a few hours a very pronounced peroneal palsy in the right leg. Later there was a recurrence of temperature and a small collection of fluid was found in the right forearm. This was incised and drained with good results.

From June 18 to July 13 he received massage three times a week for his foot drop. He was then discharged, with all wounds closed except the knee, treated in the surgical dispensary and also received massage.

On July 29 we were forced to readmit him for a few days, due to intense edema of the right leg, due to too tight a bandage. After his discharge a second time, he was again treated in the surgical and massage dispensaries and a special support put in the right shoe to overcome the toe drop. When last seen, he had full knee motion and had partial return of peroneal function.

As a result of this case, and several subsequent cases, we are convinced that with a positive finding of streptococci in the blood stream, Pregl's iodin intravenously is of marked benefit and is without marked febrile reaction, and, except in endocarditis, is without danger. A small series of these cases has convinced us that if temperature persists after the administration of the iodin, the primary focus is insufficiently drained, or a secondary collection somewhere is either undrained or insufficiently drained.

Unless promptly drained, the blood stream again becomes infected. Therefore, we would like to suggest that the continuation of temperature after the administration of Pregl's iodin in a case of streptococcus blood stream infection be considered as a definite sign of insufficient surgery.

This is the third case within the experience of one of us (W. B.) where the primary infection was in the mastoid, the blood stream infected, and the sacroiliac joints were the first places to show secondary localized collections of pus. The other two infections were staphylococcic; one was treated by mercurochrome intravenously, incision and drainage; the other one by incision and drainage alone. All three of these cases recovered and, contrary to expectation, the involvement of the sacroiliac joint healed promptly, with no symptomatic after-effects.

In the case reported by Potts in the young woman, there was a similar sacroiliac accumulation with complete recovery.

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# THROMBOSIS OF THE LATERAL SINUS, WITH EROSION OF THE OVERLYING BONE, THE SINUS HAVING BEEN OPENED AND DRAINED THROUGH A SKIN INCISION.

DR. ERNEST M. SEYDELL, Wichita, Kan.

The following case report represents a type of termination in a case of suppurative sinus thrombosis, unlike any I have seen reported in the literature:

Mrs. F. S., female, white, age 25 years, married.

*Past History:* Measles, pertussus and mumps, the latter being unilateral, during childhood and appearing on the right side two years ago. Frequent attacks of tonsillitis during childhood. Pneumonia and splenic enlargement at the age of 16 years. Patient has given birth to two children. Second degree tear during delivery of last child. Both children living and well.

*Family History:* Mother dead. Tuberculosis and diabetes. Age 59 years. Father living, has some cardiac disturbance. Five sisters and three brothers living and well.

*Present Illness:* Influenzal attack began Jan. 13, 1926, with fever, malaise and general muscular aching. Patient states that she was confined to bed three or four days and was very weak for several days after resuming her household duties. One week after the onset of the influenza she developed a severe pain in the right ear. Home remedies were applied and the ear was allowed to rupture spontaneously; this occurred after one week of pain. At first the ear began to discharge a thin watery secretion, but pain was not relieved. A peritonsillar abscess developed which was not lanced but subsided without surgical intervention. A week later the patient consulted a physician and the right drum was lanced. Local treatments followed for a period of four weeks. During this time she was never free from pain. Her physician then decided that a mastoid operation was necessary. Roentgen ray pictures were taken and white blood counts were made before the operation.

On April 7, 1926, a mastoid operation was performed on the right ear. The patient was in bed for thirteen days following the opera-

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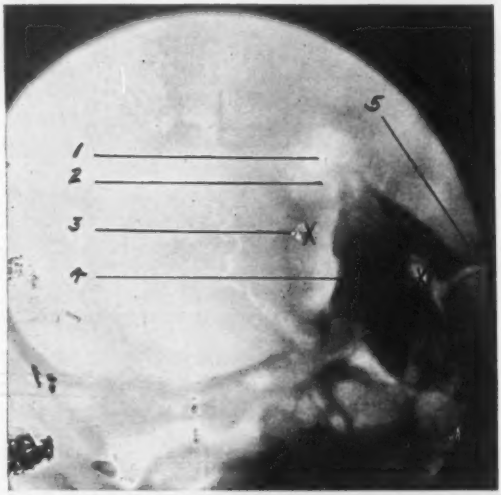
tion. During this time she had fever, pain and a continual discharge from the right ear. The pain was more marked during the night. Her physician dressed the wound every day for three weeks. At this time a swelling appeared over the right temporal region and back of the mastoid. The right eye was also black and swollen. At this time her physician began treating her three times daily. The swelling and ecchymosis remained about four days, the pain was intense and the ear continued to discharge. About this time the physician opened a fluctuating swelling at the upper part of the former mastoid incision. A large quantity of pus was found and




1. Clean cut opening in temporal bone due to erosion following sinus thrombosis. 2. Area around opening necrotic, but not completely destroyed. 3. Defect subsequent to first operation. 4. Middle ear (external auditory canal). 5. Root of zygoma.

evacuated, following which the swelling and ecchymosis subsided and the pain was somewhat relieved.

A week later the same symptoms returned. On May 21, 1926, she came to me for consultation and advice.

*Chief Complaint:* Pain, generalized headache, fever, soreness and stiffness in the right side of the neck. No history of chills or high fever.

*Physical Examination:* Patient was a well developed, rather obese female. Facial expression showed pain and suffering.

*Head:* Scalp negative, except for scar and small discharging wound in the right mastoid region.

*Eyes:* Pupils equal, regular and respond readily to light and accommodation. No nystagmus.

*Ears:* Left, negative. Right, canal filled with slightly malodorous discharge which when removed revealed a small perforation of the drum, centrally located. The posterior-superior canal wall showed some drooping, and the external canal was generally narrowed and edematous. The post-auricular crease was obliterated with edema and redness and tenderness over the entire mastoid region. Some swelling in the temporal region also existed.

Classical mastoid scar, in the upper portion of which there was a small discharging fistula.

*Nose:* Negative.

*Throat:* Negative, except for chronic septic tonsils with a marked degree of hypertrophy.

*Cervical Region:* Negative, except for tenderness and some rigidity along the sternomastoid muscle on the right side, and a generalized cervical gland adenopathy.

*General and Neurological Examinations* were negative.

*Laboratory Findings:* White cell count, 19,500. Microscopic study of smear from ear and mastoid wound showed a mixed infection, the streptococcus mucosus predominating.

*Urinalysis:* Negative, no albumen or casts, few pus cells.

*Roentgen Ray Examination:* Roentgen ray picture of left mastoid presented a poorly developed mastoid of the pneumatic type. Left sinus was high and forelying in its position. No pathology was seen in mastoid cells. The right mastoid picture revealed a narrow cavitation which no doubt was the result of the former mastoid operation. From the picture it was evdient that the antrum had not been opened. Above the cavitation a round, clean-cut opening in the bone was visible. The site of the opening corresponded to the knee of the lateral sinus.

A re-opening of the mastoid was advised. The operation was performed on May 22, 1926.

*Operative Procedure and Operative Findings:* Under general anesthesia the former mastoid incision was reopened and the wound

retracted. A narrow cavity, filled with granulation tissue, was found. This cavity occupied the central portion of the mastoid process. About 6-7 m.m. above the upper margin of the mastoid excavation a clean-cut, round opening in the bone was visible. This opening was plugged with granulation tissue. In its immediate vicinity several areas of softened bone were found.

The granulation tissue was removed from the mastoid cavity. The tip was thoroughly cleaned and the antrum, which had not been previously opened, was entered from above and in front, this procedure being necessary on account of an extremely forelying sinus.

The sinus was found uncovered below the knee, but at this point appeared normal. After the mastoid had been exenterated it was apparent that the small opening above the mastoid led into the lateral sinus. The sinus was laid bare, both backward and downward. After the overlying bone had been removed, it was found that the sinus was thrombosed behind the knee and that its outer wall had been destroyed by the infection, which had also caused an erosion of the overlying temporal bone. Several teaspoonsful of pus were removed from the center of the thrombosed area. As there were no general septic symptoms, no attempt was made to establish a flow of blood from either end of the sinus. The wound was carefully packed. The skin incision was allowed to remain open.

The patient made an uneventful recovery.

*Resume and Conclusions:* The patient under discussion had a typical suppurative mastoiditis. The first operation was incomplete, probably due to the presence of the forelying sinus. Following the operation the patient developed a sinus thrombosis which destroyed the outer wall of the sinus and eroded the overlying bone and finally presented itself as a fluctuating swelling above the upper end of the mastoid incision. This was opened and drained by the attending physician, three weeks subsequent to the first mastoid operation.

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## THE BACTERIOLOGY OF ACUTE EARS.

Dr. V. K. Hart, Statesville, N. C.

The writer has for some time been interested in this phase of otology; particularly since the recent epidemic of acute ears which seemed to be widespread over the country. Does the same organism predominate in an epidemic? What real practical value from a standpoint of prognosis comes from a bacteriologic study of suppurative otitis media? Do therapeutics depend on the type of infection? With these ideas in mind, the question is reviewed.

Textbooks all have the same stereotyped remarks to make about the infecting organisms. All agree that those of the streptococcus group offer the worst prognosis. The streptococcus mucosus is generally considered the worst offender of the group.

Loeb also considers the pneumococcus combined with micrococcus as of bad outlook. Hays thinks the streptococcus group the worst offenders as to complications. Kerrison states that the streptococcus and pneumococcus lead more frequently to intracranial complications than other micro-organisms. He stresses the importance, however, of the relation of the patient's resistance to the virulence of the infection. Thus the former may be high and the latter low, or vice versa. This equation is unquestionably important. Therefore, an organism of ordinarily low virulence may give rise to complications if the patient's resistance for one reason or another is low.

The writer's technique of making a smear and culture has been a simple one. The canal is cleansed of superfluous discharge and wiped with alcohol. A sterile applicator is then applied directly to the drum membrane at the point of exit of the pus and a smear and culture made. Care should be taken not to touch the canal wall. Loeb suggests that the pus be taken from the middle ear by means of suction. This added trouble is not really necessary. Recently tincture of iodin has been used in the canal because of frequent staphylococcus contamination of cultures.

A gram stain is asked for routinely on all smears. Culture is made on blood agar as all the organisms commonly found in acute otitis media will grow readily on this type of media.[4]

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Experience has taught that more reliance may be placed in the smear than the culture. At least this has been the author's experience. Many times a staphylococcic contamination from the canal wall crowds out any other growth on the media. (Sometimes there is no growth at all.) Consequently, a staphylococcic culture must be interpreted with the smear. If the organisms predominating in the smear are staphylococci and the culture also shows the same organism, then the infection may be put down as staphylococcus. This holds true for other types of infection; *viz.*, if the smear and culture agree. However, if the smear shows an abundance of gram-positive diplococci and the culture reported as staphylococcus, the infection is put down as pneumococcus and tentatively treated as such pending further study. Practically always other cultures will confirm the smear.

With the remarks of the preceding paragraph as a guide, twenty-two cases are herewith reviewed as to complications and bacteriologic findings. Eighteen of these came under observation in the last three months during an epidemic of acute ears. The others are mentioned because of complications.

*Resume of Findings. Case 1:* Baby, age 7 months. Pneumococcic infection. There was also a group of acid-fast organisms in smear stained for tuberculosis. This was made because of a severe adenitis on the same side with abscess formation. Moreover, the father gave a history of tuberculosis two years prior to birth of baby. Result: ear dry and no complications. Neck still draining. No tubercular organisms demonstrated in cervical pus.

*Case 2:* Baby, age 2½ years. Smear and culture negative. Result: recovery and no complications.

*Case 3:* Baby, age 10 months. Came under observation with acute mastoid right with frank subperiosteal abscess. Operated. Infection; pneumococcus and micrococcus catarrhalis. Result: uneventful recovery after mastoid operation. During convalescence developed acute streptococcic ear left. Recovered with no complications following myringotomy.

*Case 4:* Girl, age 13 years. Pneumococcic infection. No complications, although patient returned to her home in New York before ear dry.

*Case 5:* Male, age 60 years. Infection; pneumococcus and micrococcus catarrhalis. Recovery without complications following myringotomy.

*Case 6:* Male, age 22 years. Bilateral acute suppurative otitis. Left, infection; pneumococcus and short-chained streptococci. Right, infection; pneumococcus and micrococcus catarrhalis. Recovery following bilateral myringotomy with no complications. Convalescence much prolonged.

*Case 7:* Female, age 23 years. Pure staphylococcic infection. Recovery after myringotomy. Much mastoid tenderness early in course and X-ray showed some clouding about antrum. Recovered without operation.

*Case 8:* Male, age 5 years. Streptococcic infection. Developed acute mastoid with subperiosteal abscess. Recovered after mastoidectomy.

*Case 9:* Male, age 19 years. Staphylococcic infection. Recovery after myringotomy with no complications.

*Case 10:* Male, age 40 years. Unidentified Gram-positive bacillus. Recovery after myringotomy.

*Case 11:* Female, age 45 years. Pneumococcic infection. Recovery after myringotomy.

*Case 12:* Male, age 37 years. Acute right ear. Infection; staphylococcus. Recovered without complications following myringotomy.

*Case 13:* Female, age 6 years. Bilateral acute ears. Smear and culture right, negative. Left, pneumococcus. Second smear and culture right, both showed pneumococci and streptococci. Recovery without complications following myringotomy.

*Case 14:* Male, age 8 years. Acute left ear. Infection; streptococcus and pneumococcus. Recovery without complications after myringotomy.

*Case 15:* Child, female, age 7 years. Infection; pneumococcus and streptococcus. Recovery without complications following myringotomy.

*Case 16:* Child, female, age 6 years. Infection; pneumococcus. Recovery without complications following myringotomy.

*Case 17:* Baby, age 10 months. Bilateral suppurative ears. Infection; staphylococcus each side. Recovery after myringotomy with no complications.

*Case 18:* Male, age 19 years. Acute right ear. Smear showed Hay bacillus and Gram-positive diplococci. Culture showed Hay bacillus. Recovery after myringotomy without complications. Considered a pneumococcic infection.

*Case 19:* Female, age 20 years. Infection; micrococcus catarrhalis. Developed a severe nephritis and an acute mastoiditis. Complete recovery from both ear and kidney complications following operation under local anesthesia. (Reported in detail with tabulation kidney functional tests in Southern Medicine and Surgery, Dec., 1925.)

*Case 20:* Female, age 23 years. Infection; micrococcus catarrhalis. Developed frank mastoid. Recovered after mastoidectomy.

*Case 21:* Female, age 37 years. Pneumococcic infection. Developed acute mastoid. Recovered after mastoidectomy.

*Case 22:* Female, age 49 years. Came under observation with acute mastoid. Operated as emergency operation and smear and culture not made. Three weeks after mastoidectomy developed classical signs of lateral sinus phlebitis. One blood culture was negative. Not considered safe to wait for further cultures and lateral sinus obliterated and internal jugular vein ligated. Four days after second operation symptoms of meningitis supervened. Sediment from centrifuged specimen of spinal fluid showed an abundance of short-chained streptococci. Lethal termination.

*Discussion:* The common organisms found in acute suppurative otitis media are readily differentiated by means of a gram stain. Thus, the three common gram-negative diplococci are the meningococcus, gonococcus and micrococcus catarrhalis. One would not expect to find the first two in acute otitis. Friedlander's pneumobacillus is gram-negative. Bacillus pyocyaneus is gram-negative; so also is the Pfeiffer bacillus, which is one of the smallest known pathogenic bacteria. The common nonpathogenic contamination is the hay bacillus (B. subtilis), which is gram-positive.

If it is necessary to differentiate the pneumococcus of Group 3 from the streptococcus mucosus, more elaborate laboratory technique is necessary. (Pneumococcus is soluble in bile and will ferment inulin.) However, this is not usually necessary because streptococcus mucosus is relatively uncommon. Furthermore, the prognosis of either is bad.

The discharge in a pneumococcic infection is often of a mucoid character and tends to be "stringy". That of a staphylococcic in-

fection is exceptionally profuse and thick. Micrococcus catarrhalis will also give a thick, profuse discharge. If the discharge tends to be more of a serosanguineous character, and particularly if the pain is out of proportion to the amount of discharge, one should be suspicious of a streptococcic infection.

The first case mentioned was most interesting, because in the smear there was a group of acid-fast bacteria whose morphology was identical with the tubercle bacillus. Furthermore, it was logical to assume that the infection had spread through the lymphatics to the ear, inasmuch as the glands were first involved. There was also a history of tuberculosis in the father.

However, the ear became dry in a short time and the drum healed. This is not typical of tuberculosis. The tendency to chronicity, multiple perforation of the drum and early bone involvement are well known. These the patient did not have.

It must be remembered then that there are other acid-proof bacteria beside tubercle bacilli.[2] Such have been isolated from substances such as butter and hay. In view of the clinical history, very probably the organisms found in this smear were one of the some forty varieties that have been described. Animal inoculation is the best way to make a differential diagnosis bacteriologically. In this case the prompt recovery from the ear infection ruled out tuberculosis.

Just a few words as to therapy. Such was occasionally varied, depending on the type of infection. Thus, ethylhydrocuprein 1 per cent was tried in some cases of pneumococcic infections. Some of the patients with this type of infection seem to do better than with other antiseptics, such as mercurochrome 5 per cent or alcohol and boric drops, but the results have not been startling. Neutral acriflavine seems to have no advantage over the two last-named preparations.

Moreover, in the case of a gram-negative infection, such as with micrococcus catarrhalis, alcohol and boric drops seem to work just as well as 5 per cent mercurochrome. In other words, one cannot choose an antiseptic merely on the staining reaction of the organism. These remarks are based not only upon the series under discussion but upon many other cases treated by the writer.

*Summary:* It would seem that in the recent epidemic one type of infection was not exclusively found, but pneumococcus and pneumococcus combined with micrococcus catarrhalis or streptococcus predominated in the series under discussion (thirteen ears). The explanation is probably due to a protracted winter season inter-

polated with variable temperatures, as a result of which there were many acute upper respiratory infections with the ear as a secondary focus. *2.* In the series were five acute mastoids, one with lethal termination. Two were result of infection with micrococcus catarrhalis; one pneumococcus; one pneumococcus and micrococcus catarrhalis combined; and two of streptococcic origin. Micrococcus catarrhalis then assumes a more important rule than usually given it. In fact, in the author's experience it has as bad a prognosis as pneumococcus, though not as likely to cause intracranial complications as the pneumococcus or streptococcus. The one intracranial complication was caused by streptococcus. *3.* Essentials of successful treatment seems to be early and free incision. It may be necessary to open the drum several times if it shows a tendency to heal prematurely. One antiseptic seems to work as well as another, irrespective of the type of infection, with the possible exception of 1 per cent optochin in a pure pneumococcic infection. *4.* In cases of bilateral ears the same organism is not necessarily the operative factor on each side, though usually the same organism predominates. *5.* It is interesting to note the frequency of a mixed infection.

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Davis Hospital.

## THREE UNUSUAL ENDOSCOPIC CASES.

Dr. John D. Kernan, New York.

Endoscopy being as yet an undeveloped art, except in foreign body work, its possibilities can be brought out only by its widest use in a large variety of cases with reports as to results. This being so, it appears to the author that the following three cases will be of interest.

The first case is one of papilloma of the lower end of the esophagus in a child age 10 years, seen at the Babies' Hospital on the service of Dr. Frank Elmer Johnson. The history is that since birth the child had a spasmodic stricture of the esophagus, which came on suddenly when eating. It would leave as suddenly as it came. X-ray showed stricture of the esophagus with the dilatation above it, near the lower end.

An esophagoscopy was done June 29, 1926. There appeared to be a thickness of the wall of the esophagus 20 c.m. from the teeth, involving the left and anterior wall. The mucous membrane in this area appeared to be rough, fissured and was quite vascular when brought in contact with the tube. A section was taken. This tissue was reported by Dr. Martha Wollstein to be a papilloma.

*Pathological Examination:* The specimen on examination was a globular piece of tissue 4x4 m.m. in diameter. It was gray in color with a red spot where it had been cut from the esophageal wall. Its other surface was irregular and smooth.

*Microscopic Examination:* The central part of the small section is made up of a thin fibrous connective tissue, arranged in a papillary manner, with numerous fibroblasts and near the point of attachment to the wall of the esophagus there is a mass of unstriped muscle cells. The covering epithelium which dips between the papillae is of a stratified pavement variety, normal to the esophagus. The other surface is quite smooth; blood vessels, small, thin walled and fairly numerous. Two small traumatic hemorrhages are present at the base of the papilla. The growth is not malignant.

The second case is one of lipoma of the bifurcation of the trachea. I have been unable to find any other such case as this reported in the literature.

The man was age 50 years, with a history of having had a severe cough for five years, so bad at times as to nearly incapacitate him.

**Editor's Note: This ms. received in The Laryngoscope Office and accepted August 5, 1926.**

He had been under treatment for chronic bronchitis and asthma during this entire time, without securing any relief. The signs in the chest were chronic bronchitis and asthma. In appearance he was a thin, sickness-worn man, who had evidently lost much weight. He was referred to me for bronchoscopy with a possibility of there being a foreign body in the lung.

On bronchoscopy a tumor, measuring ¾x½ inches, was found attached to the right side of the bifurcation of the trachea by a broad pedicle. This tumor moved up and down with respiration and the irritation of its movements was evidently the cause of his symptoms. It was removed by biting across the pedicle with biting forceps and then grasping it with double-pronged forceps and evulsing the small bit of mucous membrane which still held it in place. The man was at once relieved of his symptoms.

The case appears to be so unique that a pathological report is given in full, with a photograph of the growth.

Pathological Report: Diagnosis: Submucous lipoma of trachea. Gross appearance: The specimen consists of a spherical tumor designated as "tumor of lung." It is in formalin. It measures 2x1 c.m. One surface is covered by a thick membrane, while the other or attached surface is irregular and tough and shows slight hemorrhage on the surface. On section there is disclosed a ball-shaped tumor mass beneath the membrane and easily removable therefrom. It is firm and yellowish in color and resembles fat tissue. The tumor floats in the fixative (formalin).

Microscopical examination of sections of the tumor shows the bulk of the growth to consist of mature fat cells supported by strands of vascular fibrous tissue or merely by blood capillaries. At the periphery of the tumor the fibrous tissue is abundant and predominates over the fat tissue. It shows considerable mucoid degeneration. The tumor is partly covered with mucous membrane, the epithelium of which is of the stratified columnar type. The epithelial cells show no evidence of cilia. The stratum proprium is infiltrated with small round cells.

This case is of especial interest as illustrating the possibilities of bronchoscopy in the way of explaining obscure chest conditions.

The third case, that of a woman, age 45 years, was first seen March 17, 1926. She was referred to the author by Dr. James Alexander Miller, of New York. Her illness had begun seven months before with what appeared to be an attack of acute bronchitis and asthma. The cough was accompanied by consderabile spitting of blood. After the acute symptoms had subsided she continued to

raise the blood every few days. Then she had a period of freedom from symptoms of five weeks. Two weeks before she was seen the bleeding began again with attacks of what were thought to be asthma at night.

Examination with the laryngoscope showed a reddish-looking mass in the trachea on the left side. It had the appearance of angioma.

On April 20, 1926, at the Lenox Hill Hospital, under local anesthesia the large pedunculated growth was removed from the trachea on the left side just below the vocal cords. It was friable and very vascular. The pathology is given in full:

Diagnosis: Xanthoma or fibroscarcoma of a bronchus, possibly malignant. Gross appearance: The specimen consists of four small fragments of tissue designated "tumor from bronchus" and received in formalin. The largest measure 1.2x1x0.6 c.m. It has been cut; the outer surface is smooth and glistening. The cut surface is smooth, opaque and yellow in color. The smaller fragments are similar in appearance and on section.

Microscopical Examination: Sections of the tumor show a connective tissue growth composed of cells of various shapes and sizes embedded in a fibrous matrix. The latter is fairly abundant in places, though for the most part it is scanty and in areas it is imperceptible. Some of the cells are round, oval, spindle or irregular-shaped. The spindle cells are sometimes packed close together in bundle formation. Among these cells are large cells with one to several large chromatic nuclei, and masses of syncytium containing numerous small, round nuclei sometimes arranged in the form of a ring. Scattered through the tumor are many clear cells containing limpoid material. In one part of the tumor there are observed small nests of polyhedral cells suggesting epithelial cells. Miotic figures are not observed. In spite of the absence or rarity of mitoses the tumor is so cellular in places as to suggest a malignant neoplasm. The tumor is covered with bronchial mucous membrane richly infiltrated with inflammatory cells, plasma cells predominating. In areas the tumor reaches to the bronchial epithelium.

Section stained by Sharlach R shows a large amount of fat in a great many of the cells, the fat being in the form of globules or granules.

Tumors of this type are either classed as xanthomata or fibrosarcomata, showing xanthomatous changes.

## THE NEW YORK ACADEMY OF MEDICINE.

SECTION ON LARYNGOLOGY AND RHINOLOGY.

*Regular Meeting, Oct. 27, 1926.*

**A Case of Antral Sinusitis Complicated by Radium Poisoning.** Dr. Frederick B. Flinn.

*(To appear in a subsequent issue of* THE LARYNGOSCOPE.*)*

DISCUSSION.

DR. JOHN E. WELCH: The case was under my observation in the Knickerbocker Hospital, where the patient had trouble in eating and was threatened with lockjaw. I washed out the antrum and found it filled with very foul-smelling pus. The next day it was washed out again, but as it was found impossible to wash it sufficiently, it was opened. The surgeon in charge used a bivalve instrument which could be inserted and left in situ for an hour or so at a time, screwing it open. This was kept up for a while, and finally she was transferred to the Manhattan Eye, Ear and Throat Hospital under Dr. Flinn's care. The X-ray showed the mandible to be rather porous—a sort of osteoporosis, an increase of the pores of the bone—so it was thought to be rather hazardous to force the jaws open. She was put under ether and after a while we got the jaw open and did this operation. We expected to find the antrum full of polypi, but there were only one or two present. The antrum was full of very foul pus. We made a window in the antrum, took away the inferior turbinate bone, scraped the mucous membrane, and put the packing back. The patient improved very slowly, but finally the discharge became practically nil, and she improved as she got a couple of transfusions. I dropped out of the picture then and someone else took charge.

DR. WHITE: Dr. Flinn has covered the main points. The patient was admitted to the hospital during my absence. According to the history of the case, she was about the same as a short time after the operation on the antrum. The condition of the alveolar processes of the lower jaw had all the appearances of those patients suffering from phosphorous necrosis of the jaw; in fact, I thought this was the condition present, but Dr. Flinn assured me no phosphorous was used by the patient in her daily work. Locally, the necrosed areas were irrigated with a saline solution, followed by irrigation with a small amount of 1 per cent mercurochrome solution. Sluggish granulations were stimulated by means of silver nitrate. Dr. Hubert was asked to take the patient in charge in regard to the light therapy and I will ask him to give you an account of this treatment.

I would like to ask Dr. Flinn to explain the treatment with ammonium chlorid as I did not clearly hear his remarks on this point.

DR. HUBERT: I cannot tell the effect of light on this particular patient; but we had one patient with a radium burn of the tonsils, and the only thing that helped was ultra-violet rays. I tried to use the same light on the patient under discussion, but she objected to it, thinking that the swelling of the cheek was due to the few light treatments she had.

DR. FLINN: It was thought on account of the similarity between lead, calcium and radium that the same method for increasing the elimination of the element might be used as had been found to be beneficial in lead poisoning cases. From this line of reasoning ammonium chlorid was given in small doses; but the patient objected to even small doses, not because of any effect that it had, but from stubbornness. She was a difficult patient to handle.

**A Case of Lung Abscess Following Tonsillectomy.** Dr. J. D. Whitham.

*(To appear in a subsequent issue of* THE LARYNGOSCOPE.*)*

DISCUSSION.

DR. GOTTLIEB: I would like to ask Dr. Whitham to tell us the method of treatment he used to clear up this lung abscess, also whether he has had any

deaths following acute lung abscess. I ask this for my own information, for at the Greenpoint Hospital we had a case following tonsillectomy that had a surrounding area of pneumonia in the upper lobe. The X-ray picture indicated that and yet almost all the discharge came from the middle lobe bronchus. We bronchoscoped the child twice. He was very sick. During the second bronchoscopy I instilled solution of acriviolet, 1-200, in the middle lobe bronchus. The child died five days later. During these five days the temperature gradually declined, but the pulse became gradually weaker and the child died, probably from a pronounced asthenia.

DR. G. E. DAVIS: The report of only one case of lung abscess in 56,000 tonsillectomies is certainly very interesting and unique in the annals of hospital clinics—not believable! Are not these patients instructed to return for after-treatment?

DR. WHITHAM: They are told to return after seven days and again after thirty days.

DR. DAVIS: That is something beyond my comprehension. In all probability these patients have not returned to the hospital following the operation. Undoubtedly they have been directed to some other hospital by some other doctor.

DR. FORBES: This opens up a very broad subject for discussion and could well occupy the rest of the evening. Unfortunately, Dr. Whitham did not give us his line of treatment, nor the type of abscess, nor did he go into the present idea of the pathology of lung abscess. Certainly from the gangrene following so quickly, it looks as if in the case there was a blocking off of the vessel which caused an embolic process, rather than infection of the trachea.

In reference to the number of cases, I have something to say about the number of cases that have drifted away to some other hospital when complications occurred after operation. I thought for a long time that we had wonderful results in our submucous cases, but later I was told by a medical man in Brooklyn that he had seen a number of these patients with infection following submucous resection that we did not know anything about.

Some five years ago I read a paper on the bronchoscopic treatment of lung abscess before the International Congress in Paris. I had collected some sixty cases in the United States. After I read my paper, a very delightful Englishman said to me: "Doctor, how very unfortunate you have been—sixty cases in your hospital work." I told him that this was from all over the country. One certainly gives very wrong impressions to the listener if not emphatic in his statements. Certainly, Dr. Whitham does not feel that only one abscess of the lung occurred in a series of fifty-odd thousand tonsillectomies.

DR. LORE: I was brought into this case by Dr. Whitham, and saw the patient when she was developing the lung abscess. It was very interesting to watch its development with the X-ray pictures.

I think Dr. Whitham omitted this purposely; viz: that after ten days she had a very great fit of coughing, followed by profuse expectoration. She was bronchoscoped by me after this coughing spell and a fibrinous exudate was found at the level of the entrance to the right upper lobe bronchus. There was a very dense exudate covering this bronchus and occasionally I could see a bubble of air coming out, but at no time was an attempt made to introduce a suction tube into it. It was considered wisest to be conservative; all I did was to remove some of the fibrinous exudate and introduce a solution of diluted lipiodal. I claim no credit for the cure of this case, believing it to be a case of spontaneous cure. She also had postural treatment. If you examine the statistics, you will find that 20 to 30 per cent get well spontaneously. The interesting point is: When is bronchoscopy indicated? And what a job we have in the general hospital in trying to convince the medical men that at least one bronchoscopy is indicated in the early stages, excepting, perhaps if an acute pneumonitis exists! Of course, you have to be sure that the abscess communicates with a bronchus, otherwise you would not be justified. The feeling was all the time that there was a foreign body there. The immediate spontaneous cure made us feel that the foreign body lodged against the bronchus and as soon as that was expectorated the patient got well. I know of another case of lung abscess which spontaneously got well, while the men were deliberating what was to be done. There have been others, however,

which did not do so well. One patient had a tonsillectomy and developed a lung abscess, and it was found that there was also a tuberculous condition present. I would like to know what others believe to be the indication for a bronchoscopy in acute lung abscess.

DR. HELLER: Were the adenoids removed before or after the tonsillectomy? As there are more lung abscesses following general than local anesthesia, it would seem that this is what happens: The patient is anesthetized and when fairly under, the tonsils are taken out first. Then as the patient is coming out, the surgeon, especially if inexperienced, hurries through the adenectomy and pieces of tissue, more or less loose, might remain in the nasopharynx, to be later aspirated into the lung. This does not account for the embolic cases, but there are more foreign body than embolic cases. Blood itself does no harm I am sure, for if that were so, pulmonary abscesses would be far commoner following hemorrhage in tuberculosis where the lung may contain large quantities of blood for a time. Adenoids are not fibrinous like blood and readily absorbed, but solid glandular material and may easily block off a bronchiole. In our institution we remove the adenoids first. There is no reason why this should not be done, except that we have not been doing it that way. The first automobiles had the right hand drive because a buggy had the whip on that side. It was changed to the left as soon as its advantages became apparent. In removing the adenoids first, the patient is under fairly deep anesthesia, all particles of tissues removed and the fossa plugged if necessary. After the tonsillectomy, the plug is taken out and the bleeding usually has ceased, the field is clean and the subsequent retching and vomiting is quite unlikely to induce aspiration into the lung.

Replying to an inquiry from Dr. White, Dr. Heller said that he uses the LaForce Adenotome.

DR. FORBES: I have never thought that the presence of fever was a contra-indication to bronchoscopy in these cases of lung abscess. The earliest bronchoscopy I have ever done in a case of lung abscess was not following a tonsillectomy, but following a distinct history of the inhalation of some foreign material in the case of a man who had been bathing at one of the docks about the city. He came to the hospital two-and-a-half weeks after the onset of the symptoms. Four or five days after the exposure in the water he had acute respiratory symptoms and ran a temperature that continued for ten days. He was in such poor condition that he was turned over to the surgeon by the medical men for an external operation. I happened to be present, and the surgeon found the man such a poor surgical risk that he refused to operate. Permission was given for an immediate bronchoscopy, and I washed out his abscess. The temperature was 104.5.° The next day the temperature was down to 101,° and then became normal. The man recovered without further washing, and went out of the hospital practically well. I did not think that fever was a contra-indication; if a foreign body is suspected, you are entitled to go in at the earliest moment after you have the diagnosis.

Another point is interesting. We all know that peanuts are the one thing that Dr. Jackson fears most. The last speaker tells of using peanut oil to dilute his lipoidal solution.

DR. WHITHAM: In the past six years, 56,411 tonsillectomies have been performed at the Manhattan Eye, Ear and Throat Hospital. The case just reported is the only lung abscess that has returned during that period. A good many years ago I saw a fatal case. That is the only other case of lung abscess following tonsillectomy that I have ever seen. I did not mean to say that out of 56,000 cases only one lung abscess developed; of course there may have been many cases that we did not know of. The child may be very sick and the parents may send for some other physician.

As to whether a case of this type is due to inhalation or to an embolus, I don't think anyone can tell. I would differ with Dr. Lore. I think it came on so rapidly that it was probably embolic. I think the question of treatment has been answered by Dr. Lore. It was very simple; except for the bronchoscopic examination, it consisted of careful feeding and nursing.

Replying to Dr. Heller: I was not present at the operation, but I am sure the adenoids were taken out after the tonsils were removed.

**Prevention and Correction of Nasal Deformities Following Submucous Resection. Presentation of Cases and Lantern Slide Demonstration.**
Dr. Jacques Maliniak.

Submucous resection of the septum is one of the most common nasal operations; in frequency it stands next to tonsillectomy and with the constant increase in specialization the number will probably grow still greater. It is evident, however, that the operation for deflected septum is often wrongly considered to be indicated. This fact should be emphasized, since aside from the ordinary risks occurring in any surgical intervention, the complications which may here follow are particularly serious because of the possibility of resulting nasal disfigurement. The relation of cause and effect is too obvious to free the rhinologist from blame. Such disfigurement is especially liable to happen with delicate women and children under 16 years of age, on account of some specific weakness in the cartilaginous septum or because of disturbance in the normal development of the nose. The question of accidental post-operative trauma might also be considered, though in the majority of cases the operative technique is at fault.

A careful study of the nasal architecture is required to avoid these post-operative complications, which are of three times: 1. Limited dorsal depression; 2. retraction of the columella with or without flattening of the nasal tip: 3. a combination of the latter two.

(Then follows a careful analysis of the bony and cartilaginous portions of the nose and of their influence in maintaining its correct contour.)

*Conclusions on Prophylaxis of Nasal Deformities.* 1. In the course of a submucous resection of the nasal septum, the quadrangular cartilage may be removed freely in its upper part, but with great precaution immediately above the nasal tip on account of the lack of reinforcement of the septum at this point by the triangular cartilages.

2. In the opinion of the author, the remaining cartilaginous bridge after a submucous resection should be at least one-half inch high at the level of the "weak spot" of the nasal dorsum immediately above the nasal tip.

3. The free edge of the quadrangular cartilage forms a part of the pillar of the nasal tip and should never be resected, especially at its dorsal and basal ends. If this is done, a flattening of the tip occurs.

4. The anterior nasal spine should be economically remodeled without ever being resected entirely.

5. A submucous resection and a rhinoplasty should be avoided during an acute or chronic infection of the nasal cavities. The two plates of the mucosa, after a submucous operation, should be held in place for twenty-four hours by a metal splint, making the uncomfortable and dangerous plugging of the nasal fossae unnecessary.

6. A septal resection in an over-sized nose has to be done after the correction of the nasal deformity.

*Correction of Post-operative Nasal Deformities.* 1. An autogenous cartilaginous graft is, at present, considered the most suitable for rhinoplasty.

2. Gillies, Jacques Joseph, Morestan, John Davies and many others who have had extensive experience with free transplants, agree that costal cartilage is the best transplant to use in rhinoplasty.

Attention is directed to the tendency of the cartilaginous graft to bend, especially when covered with perichondrium, and to reasons for or against the use of septal and auricular cartilage; also to contra-indications for the use of the bone, decalcified bone, and various other transplants that have been employed.

Ivory is considered as a good substitute for cartilage and can be used because of its similar composition when the patients refuse to furnish their own cartilage. It is a dead, organic and non-absorbable substance.

*Surgical Technique for Correction of Nasal Deformities.* 1. The dorsal depression without flattening of the tip should be corrected only by a dorsal transplant. A divided graft, extolled by some for the correction of this deformity, is unnecessary on account of the nasal architecture. Artificial angulation and doubtful cosmetic results have been noted in cases operated on in this manner.

2. Lowering of the tip due to an extensive resection of the nasal spine and quadrangular cartilage, should be remedied by transplantation of a cartilaginous support, of a form appropriate for the columella.

3. The flattening of the tip accompanied by a dorsal depression may be corrected by a single angulated transplant. The two fragments—the long one for the dorsum and the short one for the columella—are united at the region of the cut by the perichondrium, which corresponds to the nasal tip.

In all this work the surgeon has to be guided to a great extent by his artistic inclinations.

(Follow presentation of patients, lantern slides and a moving picture of a nasal plastic operation.)

Dr. Maliniak, closing: I do not remember of having seen Joseph do a complete submucous resection during the correction of an over-sized nose, although for over a year I was closely connected with his clinic.

The necessity of suspension for the columella after the shortening of the septum is too evident to be ignored by the rhinoplastic surgeon.

As I already stated in all my publications on this subject, cartilage provides the best material for a nasal transplant and has to be used if only available.

I cannot agree with the doctor that ivory should be used as transplant in correction of most nasal defects. This substance is to be considered only as a substitute for the reasons given in this paper.

DISCUSSION.

DR. JARECKY: Two years ago I saw Prof. Joseph, of Berlin, operate a number of times during three months. He is not a rhinologist, but an excellent rhinoplastic surgeon, and in all cases he operated on both the septum and deformity at the same time. Results were good. He used chiefly ivory, sometimes the cartilage of the ear, no bone.

DR. SAFIAN: I have used ivory more than any other material, but one must be sure that there is sufficient support for an ivory transplant. It requires skill to shape the ivory graft in order to make it fit properly. There must be no pressure or sharp edges in order to avoid pressure necrosis of the skin covering the transplant.

Where there is insufficient support, as in a drooping tip, cartilage must be used. Some prefer the use of the bone transplant, and I have used tibia on several occasions, but found that after about two years a great deal of absorption had taken place. I have also seen cases where cartilage transplant have undergone considerable absorption, probably due to pressure of a scar. The use of turbinate bone is not common, and I have seen a case of cyst of the tip of the nose following the use of turbinate bone, due to retention of a bit of turbinal mucous membrane.

DR. MALINIAK (closing): Joseph was not skilled in rhinological diagnosis, but I have seen cases where he did *not* do septum and deformity work at the same time. He is too clever. Cartilage is the best material for transplants and must be used where possible, ivory only where cartilage is not obtainable.

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SECTION ON OTOLOGY.

*Regular Meeting, Nov. 12, 1926.*

**(a) Mastoiditis with Gradenigo Syndrome Before Operation. (b) Mastoiditits with Gradenigo Syndrome Following Operation.** Dr. J. D. Whitham.

*(To appear in a subsequent issue of* THE LARYNGOSCOPE.*)*

DISCUSSION.

DR. KOPETZKY regretted his failure to hear the paper. He said that the "Gradenigo syndrome" is a name given to a localized meningitis which takes in the fifth and sixth nerves and produces a recognizable reaction. From the story of the Gradenigo syndrome we can draw the conclusion that other meningitides are also started in localized foci, but unfortunately we have no involvement of nerves or tissues giving a characteristic reaction.

The principles of surgical treatment of such conditions are not easy, and the problem still remains at present to find a means of knowing that a localized process has commenced and to determine where it is located. As in the Gradenigo, some cases go on to a generalized meningitis, while others resolve and are cured without surgery, without becoming generalized, so in these other minigitides which do not have localized symptoms, some resolve, while others go on to a generalized meningitis.

DR. WHITHAM: I do not wish to say much, for the Gradenigo syndrome is a big subject and one could easily spend a whole evening discussing it; but one point is interesting. i. e., something that has been writen by Cushing on the subject. He explains paralysis of the externus in cases of brain tumor; he thinks the condition is sometimes due to pressure of the cerebellar artery on the abducens nerve. He also writes as follows:

"The so-called Gradenigo syndrome has been observed as a complication of otitis media without abscess or other demonstrable cerebral lesion. I have seen several instances of this combination, in each of which the lesion was attributed to a cerebral edema, for all of the patients showed headache, vomiting and a low grade of choked disc. These edemas are presumably due to the meningitis serosa of Quincke, and in most of our cases a lumbar puncture, or a subtemporal decompression has not only relieved the pressure symptoms, but has led to a rapid subsidence of the diplopia. The fluid in all of these cases has been sterile. It is not improbable, therefore, that disturbances of this kind may be ascribed to some swelling and edema of the brain stem, which had brought about the same constricting effect on the part of the cerebellar arteries that we have described as existing in cases of brain tumor."

Cushing may be right in this theory, but most of the literature goes into the subject of Dorello's canal and localized meningitis. There are many causes for Gradenigo's syndrome. Schambaugh described a case due to extradural abscess. I thought the second case might have been an extradural abscess, and I explored the Gasserian region, but there was no extradural abscess.

**Pathology of Brain Abscess.** Dr. Joseph H. Globus.

**Diagnosis and Treatment of Brain Abscess.** Dr. Walter P. Dandy (by invitation).

DISCUSSION.

DR. ELSBERG: I have listened with a great deal of interest to the papers by Dr. Globus and Dr. Dandy and I have gained a great deal of information from their interesting presentations. I think, however, that both Dr. Globus and Dr. Dandy have referred mainly to the variety of intracranial suppuration that forms only a small proportion of all brain abscesses. They have spoken more especially of the more or less chronic abscesses and have described how thick lining mebrane is observed. Dr. Dandy has shown lantern slides of a case in which the abscess was replaced by a calcified mass; I have seen two example of this type. The majority of brain abscesses I have seen and operated upon have not been those in which the patient remained alive for many weeks, months or year, but have been abscesses in which the symptoms progressed very rapidly, in which there was early evidence of extensive interference with brain function, and many of which developed or already had a bacterial meningitis. It is only in cases of chronic brain abscess and rarely in acute cerebellar abscesses that we have found any of the symptoms and signs of increased intracranial pressure.

Not all acute abscesses have a lining membrane which can be appreciated by the surgeon. The acute abscess may have a well defined wall as well as a chronic abscess, but such walling off is certainly much more rare in acute intracranial suppuration. In these patients with rapidly advancing symptoms, it would be impossible to wait for the abscess to become encapsulated and more or less quiscent, for the pus usually contained virulent organisms, frequently hemolytic streptococcus, and the signs of meningeal infection occur early. It was formerly my belief that a patient with brain abscess, who had meningeal symptoms and in whom lumbar puncture showed organisms in the spinal fluid, was beyond help by surgical means. During the past two years. however, I have seen two patients with acute streptococcus abscesses in which

the spinal fluid contained a large number of cells and organisms. Both of these patients recovered after the opening and draining of the abscess.

It has been my custom in operations for brain abscess, to make as small an opening as possible in the bone and the dura, to place a small tube in the abscess cavity and so to fix it to the scalp that the tube is not disturbed when the dressings are changed. After some daily irrigation with Dakin's solution were used and the drainage tube allowed to remain in place for a considerable period of time, often for many weeks.

There are great difference in results that can be obtained in the surgical treatment of brain abscesses, dependent upon the cause and the location of the abscess. Frontal lobe abscesses secondary to sinus infections seem especially apt to run a chronic course and to be well encapsulated, and in this type of abscess one might well try the puncture method described by Dr. Dandy. But the acute abscesses in the temporal lobe or in the cerebellum that occur as an early complication of acute middle ear disease, usually progress with great rapidity, and if these patients are to be saved, they must be operated upon early and the abscess drained.

Abscesses due to fracture of the skull and to osteomyelitis of the cranial bone have, in my experience, much more often run a chronic course than the otitic abscesses. The metastatic abscess in the course of a bacterial invasion of the blood stream and especially the brain abscess that is secondary to pulmonary suppuration, is pretty hopeless. These abscesses are generally multiple, and it is rare to be able to drain the entire infected area. In one patient in whom the brain abscess was secondary to an empyema, wide incision of the affected part of the brain and wide drainage was followed by recovery. All of the other patients with acute brain abscesses secondary to pulmonary suppuration succumbed within a few days after the drainage of the abscess.

I was much interested in Dr. Dandy's remarks concerning brain hernia and brain fungus after operations for brain abscess. It has been my experience that if the opening in the bone is small, a fungus very rarely occurs. In fact, I have only seen it in recent years in two cases in which a large opening was made in the bone and the abscess had run a chronic course.

The results of operations for brain abscess naturally vary with the type of abscess and its location. Sometimes one will have a whole series of cases in which the patients recover, and recently I had eight successful cases recover from the operation. Since that time I have operated upon two additional patients, in both of whom there was a fatal outcome.

Dr. Coleman, of Richmond, showed at a meeting of the Society of Neurological Surgeons, a few years ago, nine patients who had had acute brain abscess, every one of whom had recovered, and all that he did was to make an opening large enough for a tube and to drain the abscess.

Therefore, a very large series of cases is necessary before one can arrive at a conclusion regarding the efficacy of one or other method of treatment. I still believe that the acute abscess will have to be drained, but it may well be possible that the chronic abscesses, especially if they contain no organisms or only organisms of a low grade virulence, can be treated in the manner suggested by Dr. Dandy.

Dr. Foster Kennedy: I have had practical experience with Dr. Dandy's great technical skill. In Baltimore last spring for two days I watched him working and came to admire his ability in handling difficult situations. I think, if I may say so after prefacing my remarks by this statement, that his great skill makes him underrate the difficulties of the task, as a whole. I agree entirely with his statement that the smaller the opening the more likely you are to save your patient. Making a bone flap, as was done fifteen or twenty years ago, and putting open drainage in a brain abscess is simply to court death; you are almost sure to produce general septic meningitis. As a matter of fact, probably the best way is to drill—not to make a trephine opening at all, but to make a still smaller opening; drill through the skull and aspirate as Dr. Dandy says, or to drain, as was said by Dr. Elsberg.

But, after all, when you have pus in the body the surgical dictum is to let it out; that is the obvious treatment. There is no dispute as to how to deal with a brain abscess—let the pus out. Is it not true that the whole difficulty in brain abscess cases is to know where it is? If you cannot make a big open-

ing, you have to know precisely where the abscess is before you put your needle or trephine in the skull; the whole law and the prophets is to know where the trouble lies; to be able to know the function of the brain; to be able to observe; to be able to deduce and to know the precise position of the abscess. It is not so easy as it sounds, but not Dandy—I wrote down what he said—said: "If precision cannot be obtained in other ways, then an air injection must be resorted to." I think, taken away from its context, no one would challenge that statement—if precision cannot be obtained in other ways, then air injections should be resorted to. The inference, however, of that statement of Dr. Dandy's, is that air injection is always precise. I challenge that. It is not so. It is frequently so, and in the hands of Dr. Dandy, who invented the method, it is more frequently so than with others; but the shape of the lateral ventricles is not constant, nor are the lines of pressure always the same. I made a diagnosis in the right frontal lobe the other day—a right frontal lobe tumor involving the right corpus callosum. It was suggested that a ventriculotomy should be done, and I felt that I was not perfectly sure of my diagnosis, so I agreed. It was done with great care; it seemed from the X-ray plate that the left frontal ventricle was occluded. It was evident that the expanding lesion was in the left frontal lobe, and not in the right. I threw up my hands and said: "I was wrong," and a left frontal opening was ordered to be done. Before this was carried out the woman died; we had an autopsy and found the tumor in the *right* frontal lobe. Dr. Stookey made a model of the ventricles; we found that the expanding lesion in the right frontal lobe had depressed the horn on the right side, the tumor had splinted the right ventricle and had held it open, and had compressed the left frontal lobe, so that air could not enter the left anterior horn, and had led us to precisely the wrong conclusion. Dr. Dandy might not have made that error—but I don't know how one could have reached any other conclusion than that the lesion was on the left side, when it was really on the right. To treat brain abscess right, one must know one's brain.

DR. FRIESNER: It must be perfectly obvious that any remarks I may make with regard to this thing are pitifully inadequate, since my experience with intracranial suppurations is small as compared with the rich opportunities of such men as Dr. Dandy and Dr. Elsberg; and yet even out of my meager experiences there are certain facts that stand out very clearly in my own mind, facts which militate perhaps a little toward one or the other side of this question.

It has seemed to me from the point of view of otitic intracranial infections that there is scarcely an essential difference between those abscesses that are encapsulated and those that are not. The decisive factor is largely a matter of time. In my mind the question is when, to, and how long may we not interfere? In other words, it is quite the view of the otologist to wait as long as possible until in all probability the acute process is well localized and shut in. On the other hand, I am sure that it is the experience of other otologists that those abscesses heal fastest which are not drained—in other words, in which there is nothing to drain. I recall at least two or three cases seen in the last ten years in which after the abscess cavity was found and a drain was introduced in the ordinary way, nothing ever drained out. In other words, a single tapping cured the abscess. It is true they were all well localized and had a definite capsule, but the attempt to drain them as we did was an absolutely futile thing. It had no purpose.

I am not in the position that Dr. Dandy and Dr. Elsberg are with regard to acute suppurative encephalitis, with or without the formation of pus—they are so dangerous at times that something must be done surgically at once. I do know that, so far as the otologist is concerned, we feel that we get better results where it is possible to do so, by waiting.

Another thing that impresses me as militating one way or another in this discussion is this: Twice in the last few years I have seen cases of apparently frank suppurative encephalitis get well without any interference, and there was an entire regression of all symptoms. In one case the process had gone so far that there were definite fundus changes. I believe it was a left-sided lesion, and there was an aphasia; yet the youngster recovered—I might say despite my efforts, for I was very anxious to explore. It seemed as though

we had every indication to do something. However, Dr. Sachs insisted that I desist, and told me that in the old days when mastoids were first done in New York, that sequence of events and that train of symptoms was not uncommon, and that he had frequently seen cases of this type recover. Certainly in the cases that I have seen with a definite firm capsule, I believe that aspiration alone would cure. I know that despite the fact that I have introduced tubes, nothing drained. With regard to the acute inflammatory conditions, I am not in position to judge. I know that many go on to fatal meningitis, but it may be that any surgical intervention in such cases might be useless.

DR. JOSEPH E. J. KING: I wish to thank Dr. Dandy for his most interesting paper. It certainly is a rather decided departure from what we have been taught, and from what I have learned, but in certain kinds of abscesses it strikes me as being a rather sensible procedure. I have seen, however, two cases of brain abscess in the service at Fox Hills which had reached the so-called stage of being "healed." In the case of one of the patients the abscess had been drained, the patient was supposedly well and was up working on the post. One night he left the post and was found to be rather obstreperous in one of the adjacent inns, and an M. P. struck him on the head. He was taken back to the hospital, and died in about two days. An autopsy was done, and the abscess cavity was found, with walls about one-quarter of an inch thick, containing inspissated material like peanut butter, together with some pus about it. The inspissated material appeared to be old, while the pus was of more recent formation. Death followed from rupture of the abscess into the ventricle. The cerebrospinal fluid obtained from a lumbar puncture was almost pure pus.

The other case was similar. The patient died in a somewhat similar manner.

I have been taught to drain abscesses by the insertion of tubes into them, and that is what was done until 1920. In that year I operated upon a case for Drs. McCoy and Craig at the New York Eye and Ear Infirmary. The abscess was a temporosphenoidal lobe abscess following mastoidectomy. In locating the abscess an opening of considerable size was made in the skull and the encapsulated abscess was found. It was opened widely, a large tube was placed in it and loosely sutured in position, through which a smaller tube was placed for the purpose of Dakinization. The patient's condition improved, when lo! and behold! about the eighth day he had a considerable hernia cerebri with partial eversion of the abscess cavity so that the tubes would not remain in place. We all thought he would be lost on account of forming a so-called "fungus." We continued to Dakinize the wound, however, and it healed with subsidence of the hernia. That was six years ago, and he is well at the present time.

Following this experience I had two cases in which the abscesses were located through small trephine openings, and drainage tubes were inserted. Both patients improved to the point where they were up walking about the hospital wards and grounds. The tubes had been shortened and finally removed. Suddenly in each case they became very ill, and died of rupture of the abscess into the ventricle. So, after having these three cases coming so close together—one of which herniated through a rather large opening in the skull with complete eversion of the abscess cavity, followed by recovery, and the other two very similar, one a temporosphenoidal and the other a frontal lobe abscess, apparently recover and then suddenly have a relapse and die—I decided that should I be called to operate upon any case of abscess located near the periphery I would intentionally do the same thing that had occurred accidentally in the first case spoken of, i. e., make an opening of considerable size directly over the abscess after it had been located, remove the outer wall of the abscess, intentionally allow it to herniate through the opening in the skull so as to have no abscess cavity to drain, and to continue the Dakinization of the wound until it had completely healed.

This procedure has been followed in other cases. The intracranial pressure is immediately reduced, the spreading of infection to the meninges is prevented by insertion of small gauze strips around the dural defect between the dura and the arachnoid so that adhesions will take place and prevent spreading of infection, and the cavity will become completely everted so that there is no cavity to be drained and no secondary pocket can form. All the cases so

treated, except those which already had meningitis, or were secondary operations on other cases which had previously been drained, have recovered and remained well. Three of them are well at the present time. One died two years after the operation of intoxication at Bellevue Hospital, and one case recently operated upon at the Fifth Avenue Hospital is doing well.

I do not think that this procedure can be used for all types of brain abscess. It cannot be done for those located at the base of the brain, for there will be no opportunity for it to herniate inasmuch as an opening in the base of the skull cannot be made. The most frequent sites, however, are the temporosphenoidal lobe, the cerebellum, and the frontal lobes. I do not believe that it will give the same results with cerebellar abscesses as with temporosphenoidal and frontal on account of its location, where distortion of the subtentorial structures may be more dangerous on account of the brain stem.

However, after seeing the number of slides shown by Dr. Globus and Dr. Dandy I feel all the more strongly that those brain abscesses which are located near the periphery, i. e., where the outer wall is from one-quarter to five-eighths of an inch below the cortex, should be treated by allowing the abscess cavity to herniate in the manner described.

I should like to ask Dr. Dandy if he has had any of these cases upon which he has operated as described, which have gotten better and for several months or two or three years, and then eventually die. Has an autopsy been performed upon any of these cases, and if so, what was the cause of death? It has been the experience of most men, I think, to have drained an abscess, relieved the pressure, and observe that the patients have become much better and may even have been eventually discharged as cured, when suddenly after a few weeks or months some severe situation or condition has developed, followed by rapid death. In most of these cases I am of the opinion that it is due to rupture of the abscess into the ventricle or into the meninges. For this reason I am opposed to the leaving of an abscess as a latent condition which may later at any time upon slight trauma flare up and result in the death of the patient.

DR. DANDY, replying to an inquiry about the diagnosis of brain abscesses, said that his reason for saying little about it was that he had nothing new to offer along that line. The diagnosis is based on the symptoms of intracranial pressure—headache, nausea, vomiting, choked disc, etc., plus indications of an acute febrile condition of the brain.

Dr. Elsberg and I probably mean the same thing; he spoke of curing acute brain abscesses; I should probably speak of them as subacute. I should doubt if any abscess is saved by operative treatment, per se, in the acute febrile stage —the first ten days or two weeks, depending on the virulence of the organism. One of my reasons for giving up drainage and substituting tapping was precisely the reason Dr. Friesner mentioned. I think we deceive ourselves about the efficiency of drainage. The tube usually plugs and doesn't drain, and all we get is a little serous discharge which is probably the reaction of the brain itself. I think we can accomplish as much by tapping when necessary as by keeping the drain in position when it can scarcely accomplish anything.

Dr. King's remarks about the recurrence of brain abscess is pertinent. Trauma to the head is undoubtedly an important cause. A case of acute infection of the brain drained or tapped is liable to recurrence of the infection for many months to come, and one must always keep on guard for its appearance. That is another reason why I feel that tapping is better than drainage. If a patient has a recurrence it will again be relieved simply by tapping. I feel that many cases rupture into the ventricle because the drainage tube or gauze injures the ventricular wall.

Irrigations of abscesses are particularly dangerous, in that they injure the wall and the contiguous brain tissue, causing an intensification rather than an amelioration of symptoms owing to spreading infections and traumatic edema.

# PHILADELPHIA LARYNGOLOGICAL SOCIETY.

COLLEGE OF PHYSICIANS.

*October 5, 1926.*

**An Improved Method for Testing the Hearing with the Spoken Voice.** Dr. David Nussbaum.

*(To appear in a subsequent issue of* THE LARYNGOSCOPE.*)*

DISCUSSION.

DR. DOUGLAS MACFARLAN: This excellent paper which represents considerable search of "sources," brings up again the reminder that we must have a voice test for hearing. Speech is the most important thing which the ear is to hear. Educators and teachers all want to know how much speech is heard, for they would know to what degree they can use hearing to educate. At least from an educational viewpoint hearing is more important than vision.

Very few realize how many factors of error enter into the speech test (or voice test). We know that it is limited to the region of greatest hearing acuity (300 to 3,000 d. v.). The factors of attention, alertness, memory and education are very great in the determination of results from this test. For this reason these factors should be made as unvarying as possible. One way to standardize the memory and education factors is to use a few commonly known words, preferably monosyllables. These words should represent all the vowels of the language. As the vowel is the heart of the word, word interpretation depends chiefly upon it. We ignore in these testings erroneous reports on the consonants as given by the patient; thus, "pat" will go for "tat." They both sound nearly alike and the vowel sound is identical.

To my mind Barany's list (which is nothing but a revamping of Wolff's original idea) is too brief. Wolff's work is in German and cannot be used unless properly translated. I use a list that I have made by selecting all the monosyllables from a table of most commonly used words. Four million words were tabulated by Brigham, of Princeton. The use of these words must level off the factors of memory and education.

The vowel sounds should be interpreted in the light of the vowel analysis made by Dayton C. Miller. His tables show the characteristic frequencies of each.

I would scarcely use the voice test for a differential test between catarrhal deafness, nerve deafness and otosclerosis. The forks and the monochord are the best methods for this differentiation. I fail to find that the auditory "perimetry" given by the audiometers gives distinctive curves in the different pathologies.

The voice test is a practical test, but it is rough. It is an excellent group test for school children, where the mean hearing of the group can be used as the normal for that test "setting." This is the Whipple test.

For individual testing we know that we cannot duplicate voice tones in intensity, pitch, articulation or color. With a phonographic audiometer we can repeat speech identically and can control intensity but the telephonic diaphragm distors at the one to two thousand frequency region.

It is well to recall that speech is most complex. Miller has analyzed the acoustic properties of the vowel "a" as in "father." There is a complex of numerous tones of varying pitch and amplitude. The first ten components have amplitudes varying from 4 to 60 imperical units. There are sixteen prominent pitches in the curves made from this sound; each has a different intensity. This makes a very colorful picture. A deafened person may hear some of the pitches, may be able to synthesize them, and may guess the whole. The synthesis and the guessing is central perception. Wright has shown that he can develop it in deaf children. The end result is that their hearing seems improved, but the elemental or peripheral factors are unchanged.

We are dealing, you see, with a rather complex subject; it has been well presented by Dr. Nussbaum.

**Present Day Office Examination for the Testing of Hearing.** Dr. George M. Coates.

Dr. George M. Coates gave a very interesting and practical talk on the present day office examination for the testing of hearing. He said the object of all office testing was to find out primarily whether the patient was deaf. The degree of deafness and the type of deafness was then to be determined and the findings recorded in order that they might be used at a later date. He emphasized that space was essential and he stated that the average doctor's office was not nearly large enough for the purpose. He thought that for the spoken voice 40 feet was necessary and for whispers 20 feet. He spoke of the problem of extraneous noises which were ofttimes beyond our control and mentioned that another disadvantage of office testing was the time necessary to complete an examination. A complete test should take about 30 minutes, although the majority of us do it in less time, especially during a busy office hour. The patient's head should be turned away so that the examiner's lips might not be seen. The testing should come only after a careful history of the patient had been secured.

In the tests the spoken voice, whisper, watch, tuning fork, Galton whistle and audiometer were employed, but standardization was necessary. The spoken voice and whisper may be standardized to a certain extent only by deflating the chest. In this way approximately the same sound might be reproduced for future reference. With the watch it was another matter, since standardization could not be accomplished on account of the difference in pitch of various watches. The solution here was to use the same watch all the time. Tuning forks and Galton whistles could be standardized by instrument-makers but Dr. Coates thought one way to do this would be by testing these instruments with a normal ear, or your own ear as a guide, provided your hearing was normal.

As far as the audiometer was concerned, standardization was not necessary, because they were all uniform, but hearing tests with this instrument alone were not complete since Schwabach, Weber and Rinné had to be taken and this could only be done with tuning forks.

DISCUSSION.

Dr. George W. Mackenzie mentioned the fact that when the patient spoke in a low voice obstructive deafness should be suspected; whereas, if the patient spoke in a loud voice perceptive deafness should be thought of.

In making the hearing tests with the voice, certain words, for instance, sixty-six, will be heard for a longer distance by the patient than the lower pitch words like "doughboy." Again, when a patient hears the higher pitched words better than the lower we should think of obstructive deafness.

In testing a patient's hearing before and after treatment, we should be very careful not to use the same words, for the reason that the patient will recognize words repeated on the second test better than words that were not used on the first test.

Regarding the whispered voice, Dr. Mackenzie agreed with Dr. Coates that in order to obtain a more uniform loudness we should use the so-called residual whisper; that is, with the lungs somewhat deflated.

As to malingerers, when making the voice test it will be observed that they are slow in repeating. They will hesitate and when they repeat the word will not sound much like the word that was spoken to them; whereas, honest people repeat promptly; and should they repeat the wrong word it will sound very much like the one that was given them to repeat.

In the use of tuning forks, one should be familiar with the behavior of the fork. Furthermore, the forks of the same pitch bought from the same stock will frequently vibrate differently. For instance, some will vibrate audibly for 150 seconds, while others will vibrate but 60 to 70 seconds. This difference is due largely to the balancing of the fork. The better balanced it is, the longer it will vibrate and *vice versa*.

In using the high pitched forks or Galton whistle, one should not forget that they are transmitted for long distances and are heard with the both ears stopped up and the nose also, and for that reason are not dependable for a unilateral testing.

I cannot allow this opporunity to pass without emphasizing the importance of the more common tuning fork tests, Weber, Schwabach and Rinné, particularly at this time, owing to the advent of the audiometer, which by no means can replace the fork tests.

DR. DOUGLAS MACFARLAN: The greatest factor of error in office examination is noise. This Dr. Coates has well brought out. Noise may be greatly reduced by the closed-method testing with telephonic devices such as audiometers or broadcasting sets (perhaps better called, small radio-talking-circuits). Here a receiver may be covered with a rubber cap that can be pressed against the ear.

It is well to remember that the normal ear can hear a moderate spoken voice 3 feet to the rear, even though the ear canal is stopped by the moistened finger.

Dr. Coates repeats a common complaint against the hearing tests—the time they consume during busy office hours. Fifteen minutes to a half-hour is not to be considered wasted when we are getting absolutely essential information for our work. The time can be arranged by appointment so that the patient comes when we are less rushed. The office girl cannot do the work, though she might take an audiometer reading. If a half-hour is carefully and intelligently taken to do this testing, it does not require much further testing at subsequent visits. Your time is cut down as your technique improves. Hurried careless work is a total waste of time, and is worse than no testing at all, for the supposed results mislead.

Dr. Coates spoke of recording the figures obtained in fork-timing by fractions, where the numerator represents the patient's hearing time, the denominator, the normal hearing time. This gives an arithmetical relation which does not exist. The relation is logarithmic and should be expressed with the relationship sign (:). The figures then are to be multiplied by the dampening factor of the fork to get the arithmetical or per cent relation. This matter is clearly brought out in Dundas Grant's paper in 1913, and lately again by Fletcher's papers.

As to standardization of forks, what this term means is the determination of this dampening factor, or the rate of decrement (or drying out) of the fork. Standardization as we use the term does not mean exactness in pitch unless we are particularly referring to pitch. Pitch exactness is very easily accomplished by the manufacturer. We should be only concerned with the general region of pitch of the fork used; it would not make much difference to me whether I was using a 488 d. v. fork or a 500 d. v. What does matter is that we must know the dampening factors of our forks. Two forks of identical pitch with different dampening factors give totally different hearing-time on the same patient, but figured out by multiplying time by the respective factors, the results are identical.

With standardized forks you can get as exact readings in sensation units as with audiometers. I feel that ultimately we will have to adopt a unit of hearing, such as the sensation unit. This idea of a unit is a great contribution by the electrical engineers, particularly by Fletcher. One of his recent papers gives a very clear exposition of the various tests for hearing, showing the comparative findings for each method.

We might as well learn to use forks intelligently, for there is as yet no substitute for the fork. We must have an A. C. or B. C. comparison, the audiometers have developed no satisfactory B. C. attachment.

DR. HARRY A. SCHATZ considered the tuning forks of considerable value, and, providing the same style of forks be used, quite reliable in the hands of experienced examiners. That the findings with the various forks can be practically identical in the same patient when the tests are made by different examiners was strikingly, though accidentally, demonstrated some years ago at the University of Pennsylvania Ear Clinic. Dr. B. Alexander Randall had completed testing the ears of one whom he regarded as being a new patient when it was learned that the same patient had been examined a few days previously by Dr. Schatz. Curiosity prompted Dr. Randall to compare the results as noted in the book; found them practically identical, and commented upon it as noteworthy.

DR. HENRY S. WIEDER mentioned a case in which the labyrinth was destroyed, yet the patient said bone conduction was present and that he heard high notes in the affected ear. The bone conduction in this instance was obviously borrowed from the good ear and the high notes were also heard in the same way. He said that the Galton whistle should be used delicately to be of service, otherwise the sound will be carried by the air and penetrate through the noise of a noise apparatus, to be heard in the good ear. He stated that the high forks were better than the Galton whistle and that the Barany noise apparatus should always be used in testing for a dead labyrinth.

DR. PHILIP S. STOUT: I enjoyed the papers of Drs. Nussbaum and Coates and the discussions of Drs. Macfarlan and MacKenzie. I was interested in the fact that I was unable to hear very well one of the speakers, although I was not more than 12 feet away from him. This shows how difficult it is to use the voice as a test for hearing. Whispering, however, can be made more accurate. I remember during the war having been requested to re-examine several aviators who had been rejected on account of their hearing, and although I have not a very good carrying voice, they were able to hear me at 40 feet and I passed them. Voice and whispering tests, notwithstanding all their shortcomings, will, no doubt, always be used as a method for testing hearings. It seems unfortunate that we do not have some method of testing the hearing as easily as we test the acuity of vision with a Shellen's card. The nearest thing we have at present is an audiometer and I am informed by one salesman that in a neighboring city the office assistant takes the hearing of each new patient with the audiometer before the doctor (otologist) sees them. This gives the examiner a general idea as to the amount of hearing. Of course, it does not give any idea as to what causes the deafness.

DR. WILLIAM G. SHEMLEY, in his discussion, stated that the solution to the problem of deciding the presence or absence of hearing was to place the Barany noise apparatus in the good ear and the 3-meter speaking tube in the affected ear. There would be no confusion then in determining the result of the test, since the noise apparatus prevented the good ear from assisting the ear under examination.

DR. COATES in closing stated that tuning forks were good, the audiometer being simply a help, as it would not give us a proper test as tuning forks did. He reiterated that it took one-half hour to perform the test properly and he again stated that it was impossible to rid ourselves of extraneous noises. He cited a case of a patient he examined in the country where the din produced by the passing automobiles, the carpenter in the house, the workmen in the yard and even the birds in the fields were a distinct detriment to the resultant findings.

Dr. Henry Dintenfass, Reporter.

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The Pfau's American Instrument Company, 2 East 23d street, New York, N. Y., are the manufacturers of the New Tonsil Expressor mentioned in Dr. A. Lobell's article of the same title which was published in THE LARYNGOSCOPE, for November, 1926. Through an oversight the name of the manufacturer of this new instrument was omitted in the original article.

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In the Index for 1926, as printed in the December, 1926, issue, the name of Dr. Arthur J. Herzig, 133 West 72d street, New York, was omitted. The title of Dr. Herzig's paper which was printed in our June, 1926, issue is "A Further Study and Clinical Report of the Use of Acriviolet in Diseases of the Upper Respiratory Tract and Ear."